ANALYSIS OF THICK ANISOTROPIC PLATE THROUGH EXACT APPROACH USING THIRD ORDER SHEAR DEFORMATION THEORY

BY

OZIOKO, HYGINUS OBINNA (B. ENG, M. ENG)

REG. NO. 20154986818

A Ph.D THESIS PRESENTED TO THE SCHOOL OF POSTGRADUATE STUDIES,

DEPARTMENT OF CIVIL ENGINEERING,

FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY (Ph.D) DEGREE IN CIVIL ENGINEERING (STRUCTURES)

SEPTEMBER, 2021

CERTIFICATION

This research thesis "Analysis of Thick Anisotropic Plates through Exact Approach using Third Order Shear Deformation Theory" by Ozioko, Hyginus Obinna (Reg. No. 20154986818) is certified as a satisfactory research thesis in partial fulfillment of the requirements for the award of Doctor of Philosophy (PhD) Degree in Structural Engineering in the department of Civil Engineering, Federal University of Technology, Owerri.

______________________	07/09/2021
Engr. Prof. J.C. Ezeh Supervisor	Date
______________________	07/09/2021
Engr. Dr. O. M. Ibearugbulem Supervisor	Date.
______________________	07/09/2021
Engr. Dr. U. C. Anya. Supervisor.	Date
______________________	11/10/2021
Rev. Engr. Prof. L. O. Ettu Head of Department.	Date
______________________	13/10/2021
Engr. Prof. J. C. Ezeh Dean, School of Engineering and Engineering Technology.	Date
______________________	______________
Prof. C. C. Eze. Dean, School of Postgraduate Studies.	Date
______________________	07/09/21
Engr. Prof. C. H Aginam External Examiner.	Date

DEDICATION

This dissertation report is dedicated to God Almighty for his mercies in my life.

ACKNOWLEDGEMENTS

I am grateful to my supervisor, Engr. Prof. J.C. Ezeh for the role he has played on the course of developing this work always encouraging me and my colleagues for earlier completion of the work. The encouragement, advice and his guide led to early completion of this work. May you be always favoured in this your field of carrier. My special thanks go to my second supervisor, Engr. Dr. O.M. Ibearugbulem for his priceless and unquantifiable contribution towards the realization of this research. He provided me with literature materials and followed up the research at every stage of the work. May God grant you multiple blessings. My special thank goes to my third supervisor Engr. Dr U. C. Anya, for his huge support at the early stage of this work. I am grateful to Prof. D.O. Onwuka and Rev. Dr. L. O. Ettu for their spiritual and academic contribution in my life and towards this work. I am also thanking Engr. Dr. Mrs. C. E. Okere, Engr. Prof. Mrs B. U. Dike, Engr. Prof. B.C. Okoro, Engr. Dr. J. C. Osuagwu, Engr. Dr. H. U. Nwoke, Engr. Dr. L. Anyaogu, Engr. Dr. F. C. Njoku, Engr. Dr. Mrs. J. I. Arimanwa, Engr. K. Onyema, Engr. Dr. Mrs. C. T. Awodoji, Engr. K. C. Nwachukwu, Engr. Dr. N. L. Nwakwasi, Engr. A. P. Amanze and Engr. A. N. Nwachukwu for their huge support toward this work. I am grateful to the entire staff and management of Civil Engineering Department, Federal University of Technology, Owerri (FUTO) ably headed by Rev. Engr. Dr. L. O. Ettu, who contributed in one way or the other to the success of this work. My thanks also go to Engr Prof. C. C. Eze, the Dean of Post Graduate School for his necessary support throughout this research work.

God will bless the management of Michael Okpara University of Agriculture Umudike, Abia State for employing me and making it conducive for me to carry out this research. My profound gratitude goes to the entire staff and management of Civil Engineering Department, Michael Okpara University of Agriculture, Umudike, Abia State for their contribution towards this programme.

I am very much indebted to my dear parents, Elder and Mrs. N. N. Ozioko, my wife, Mrs. J. N. Ozioko, my children, Miss Chimamanda, Master Obinna Jr, and master Munachimso Ozioko, and my siblings, Engr. C. E. Ozioko, Mrs. J. O. Ugwu, Mrs. M. U. Odoh, Mrs J. U. Emeachi for their love, care and support. May God bless the fruit of your labour Amen. Finally, I am very grateful to the Most High God for making this dream a reality.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DEFINITION OF SYMBOLS

a,b	Rectangular plate lateral dimensions
t	Thickness of thick plate
D	Flexural rigidity
w	Lateral deflection of the plate
Ø	Stress function
u, v, w	Component displacements in x,y and z-directions respectively
ϕ:	Total rotation of the middle surface
θ_{cx} and θ_{cy}	Classical plate theorem rotation of the middle surface
θ_{sx} and θ_{sy}	Angle between the CPT deformation line and the shear deformation line
u_c and v_c	In-plane displacement due to classical plate theory
u_s and v_s	In-plane displacement due to shear deformation theory
x, y, z	Orthogonal coordinates of rectangular plate
R, Q, S	Non-dimensional coordinates of rectangular plate
E	Young modulus of elasticity of thick rectangular anisotropic plate
G	Modulus of rigidity of thick rectangular anisotropic plate
U	Strain energy of thick rectangular anisotropic plate
V	External work on thick rectangular anisotropic plate
$\mu_{xy}\mu_{yx}$	Poisson ratio
q	Lateral load on plate
h	Shape profile
k_1, k_2, k_3, k_4, k_5, k_6, k_7, k_8	Stiffness coefficients

ε_{xx}	Strain component in x-direction
ε_{RR}	Non-dimensional Strain component in x-direction
ε_{yy}	Strain component in y-direction
ε_{QQ}	Non-dimensional Strain component in y-direction
γ_{xy}	Shearing strain in x-y plane
γ_{RQ}	Non-dimensional Shearing strain in x-y plane
σ_x, σ_y, σ_z	Normal stresses acting through the point of plane x, y, and z
τ_{xy}	Shear stress on x-y plane
Π	total potential energy of the system
SSSS	Thick rectangular plate simply supported on the four edges
CCCC	Thick rectangular plate clamped on all edges.
CCSS	Thick rectangular plate clamped on the first two edges and simply supported on the remaining two edges
CSCS	Thick rectangular plate clamped on the first and third edge, simply supported on the second and fourth edge. (i.e. clamped on two opposite edges and simply supported on the other two opposite edges).
CCCS	Thick rectangular plate clamped on the first, second and third edge and simply supported on the fourth edge.
CSSS	Thick rectangular plate clamped on the first edge and simply supported on the second, third and fourth edges.
SSFS	Thick rectangular plate simply supported on the first, second and fourth edges and free on the third edge.
CCFC	Thick rectangular plate clamped on the first, second and fourth edges and free on the third edge.

CSFS Thick rectangular plate clamped on the first edge, simply supported on the second and fourth edges and free on the third edge.

SCFS Thick rectangular plate simply supported on first and fourth edges, clamped on second edge and free on the third edge.

SCFC Thick rectangular plate simply supported on the first edge, clamped on the second and fourth edges and free on the third edge.

CCFS Thick rectangular plate clamped on first and second edges, simply supported on the fourth edge and free on the third edge.

ABSTRACT

This work presents the Analysis of Thick Anisotropic Plate through Exact Approach using Third Order Shear Deformation Theory. Total potential energy was formed based on the refined plate theory assumptions. Displacement field, kinematic relations, constitutive relations and stress displacement relations were derived from the deformed section of a thick rectangular anisotropic plate. Strain energy was formed by substituting the kinematic relations and stress-displacement relations into the universal strain energy equation. By the addition of the external work to the strain energy equation, total potential energy functional for the analysis of thick anisotropic rectangular plate was obtained. The total potential energy functional was minimized by differentiating it with respect to the changes in out-plane deflection, δw, shear deformation rotation in x direction, $\delta\phi_x$, and shear deformation rotation in y direction, $\delta\phi_y$. This yielded the governing equation and two compatibility equations of thick anisotropic rectangular plate. A third order polynomial shear deformation was employed in the governing and compatibility equations to obtain the displacement functions (deflection, w, shear deformation rotation in x direction, ϕ_x, and shear deformation rotation in y direction, ϕ_y). These displacement functions (w, ϕ_x, ϕ_y) obtained satisfied the specified boundary conditions and it gave the unique displacement functions for each of the twelve plate boundary conditions SSSS, CCCC, CSSS, CCSS, CSCS, CCCS, SSFS, CCFC, SCFS, CCFS and SCFC solved. The stiffness coefficients (K_1, K_2, K_3, K_4, K_5, K_6, K_7, K_8) were calculated for each of the twelve plate boundary conditions. The formulas for calculating the coefficients of the displacements were combined with elastic equations to determine the formulas which were used in calculating for displacements (u, v and w) and non-dimensional stresses ($\sigma_{RR}, \sigma_{QQ}, \tau_{RQ}, \tau_{RS}$ *and* τ_{QS}) at various angle fiber orientation (0^0, 15^0, 30^0, 45^0, 60^0, 75^0 and 90^0) and various span to thickness ratio, α(5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100) and for all the twelve boundary conditions. These formulas were used to analyze some typical anisotropic rectangular thick plates by the help of a functional excel worksheet program. The numerical results obtained for displacement (w) **a**nd stresses ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$) at aspect ratio of 1.0 and span to thickness ratio of, 20.0, 10.0, and 7.14286, in this study, when compared with the results of Shimpi and Patel showed percentage difference of 0.59, 1.47, 2.70; 0.62, 1.20, 1.91 and 1.31, 0.97, 3.91% which is in good agreement. Hence the developed method is recommended for analyzing thick rectangular anisotropic plates.

Key Words

Potential Energy; Anisotropic; Thick Plate; Displacement; Stress and Governing Equation.

CHAPTER ONE

INTRODUCTION

1.1 Background information

Technological progress is associated with continuous improvement of existing material properties and this has led to the expansion of structural material classes and types. Usually new materials emerge due to the need to improve structural efficiency and performance. These new materials in turn provide opportunities to develop outdated structures and technologies, and also create new problems and tasks to engineers and material scientists. One of the best manifestations of these related processes is the development of the composite structural elements which are associated with the anisotropic structural plate, to which this study is devoted.

Composite materials emerged in the middle of the twentieth century as a promising class of engineering materials providing new prospects for modern technology. Broadly speaking, any material consisting of two or more components with different properties and distinct boundaries between the components can be referred to as a composite material (Vasiliev and Morozov, 2013).

The sudden increase in the use of anisotropic or composite materials in many types of engineering structures (e.g., high rise structures, aerospace, underwater structures, automotive, electronic circuit board, medical prosthetic devices and sports equipment) and the number of journals and research papers published in the last two decades attest to the fact that there has been a major effort to develop composite material systems, and to analyze and design structural components made from composite materials (Reddy and Arciniega, 2004). The production of anisotropic material involves chemists, electrical engineers, chemical engineers, material scientists, mechanical engineers, and structural engineers. Structural engineers deal mainly with the analysis and design of these anisotropic materials.

Anisotropic plates are plates with different resistance to mechanical actions in different directions. This implies that anisotropic plates are directionally dependent as opposed to isotropic plates that implies identical properties in all directions. Examples of anisotropic plates are aviation plywood, delta wood, coated aluminum plate, alloyed metal plates and a number of other materials (Lekhnitskiy, 1968).

A plate is a structural member that is bounded by two flat surfaces, which are separated by thickness (t) (Ibearugbulem, 2016) as illustrated in Figure 1.1. Plates are widely used in many engineering applications and specifically in aeronautic, electronic, marine, mechanical and civil engineering for the construction of aircraft, circuit board, ships, bridges, vehicles, satellites, platforms, building floors and roofs, shear walls, computer hard-disk drives and other complex structures (Birman, 2011; Volmir, 1974; and Amabili, 2008).

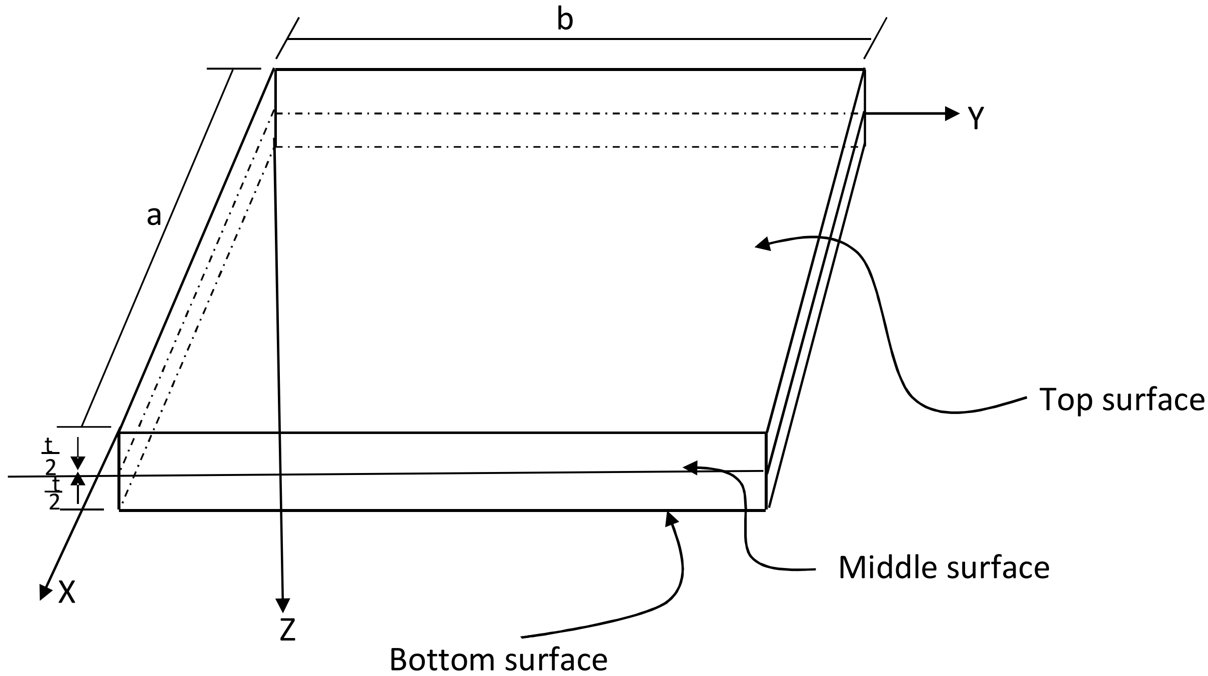


Figure 1.1: A rectangular thick plate showing the dimensions and coordinates.

The x-axis and y-axis are the in-plane axes while the z- axis is the out of plane axis. The thickness (t) is small compared with the in-plane surface dimensions ‘a’ and ‘b’ (Shufrin, Rabinovitch and Eisenberger, 2008). The thickness is usually constant but may be variable and is measured normal to the middle surface of the plate. When the plate thickness is divided equally by a plane parallel to its surface, this plane is referred to as middle surface (Ugural, 1999 and Ezeh, Ibearugbulem, Njoku and Ettu, 2013). A plate is regarded as thick plate when the span-depth ratio α is less than or equal to 10 (i.e. $\alpha \leq 10$) while the plate will be idealized to be thin when the span-depth ratio, α, varies between 10 and 100 (i.e. $10 \leq \alpha \leq 100$) (Ventsel and Krauthammer, 2001). However, it has become common knowledge that the true range of span-depth ratio for thin plate is between 50 and 100 (i.e. $50 \leq \alpha \leq 100$). The range between 10 and 50 can be classified as moderately thick plates while the range of span-depth ratio exceeding 100 is used to classify membrane plates (Ibearugbulem, 2016). Thin plates are analyzed based on classical plate theory, while thick plates are analyzed based on refined plate theories (Sayyad and Ghugal, 2012a, 2012b; Zenkour, 2013; Szilard, 2004; Reddy, 2007; Ibearugbulem, 2016). Both the analysis of thick plate and thin plate had for long been based on the trigonometric displacement functions until recently when Ibearugbulem, Osadebe, Ezeh and Onwuka (2011) and Ibearugbulem (2012) popularized the use of orthogonal polynomial functions in plate analysis. Hence, this work shall base its analysis of plate on orthogonal polynomial functions.

The classical plate theory assumed that the plane cross sections that are initially normal to the plate's mid-surface before deformation remain plane and normal to the mid-surface after deformation. This is because the transverse shear strains were neglected. However, significant transverse shear strains occur in thick and moderately thick plates. Hence, the theory gives inaccurate results for the plates. Therefore, the shear strains have to be taken into account. One of the numerous theories of plates that include the transverse shear strains is the Reissner and Mindlin theory, known as the first-order shear deformation theory, which defines the displacement field as linear variations of mid-plane displacements. This theory, in which the relationship between the resultant shear forces and the shear strains is obtained by using shear correction factors, have some disadvantages of approximating linear in-plane, constant transverse displacements through the plate thickness and choosing the problems to analyze case by case. Some other plate theories, namely the higher-order shear deformation theories, include the effect of transverse shear strains. The static or dynamic loads carried by plates are predominantly perpendicular to the plate faces.

The load-carrying action of a plate is similar to that of beams or cables to a certain extent; thus, plates can be approximated by a gridwork of an infinite number of beams or by a network of an infinite number of cables, depending on the flexural rigidity of the structures (Ventsel, 2001).

Works on refined plate theory have been characterized by the use of trigonometric displacement function. Many scholars have obtained the closed form solutions and others have obtained approximate solution using assumed displacement functions in energy method. However, one thing that is common in them all is the use of trigonometric displacement functions to approximate the deformed shapes of the plates (Chikalthankar, Sayyad and Nandedkar, 2013; Sayyad, 2011; Akavci, 2007; Sayyad and Ghugal, 2012a, 2012b; Sadrnejad, Daryan and Ziaei, 2009; Daouadji, Tounsi, Bedia and Abbes, 2013; Hashemi and Arsanjani, 2005; Reddy, 2014; Shimpi and Patel, 2006; Murthy, 1981; Zhen-qiang, Xiu:xi Mao-guang, 1994). Others have applied the assumed polynomial displacement functions in numerical methods like finite element method and differential quadrature element methods (Caliri jr, Ferreira and Tita, 2016; Rakocevic, Popovic and Ivanisevic, 2017; Kumar, Panda, Kumar and Chakraborty, 2015; Matikainen, Schwab and Mikkola, 2009; Goswami and Becker, 2013; Sahoo and Singh, 2013; Tran, Wahab and Kim, 2017). The major flaw in their traditional refined plate theory (i.e. Third order or higher order shear deformation theory) is the assumption of their displacement functions in thick anisotropic plate analysis. It is believed that these assumptions have not been solved to ascertain their validity or correctness in thick anisotropic plate analysis.

The rectangular plate has four edges numbered as shown in Figure 1.2.

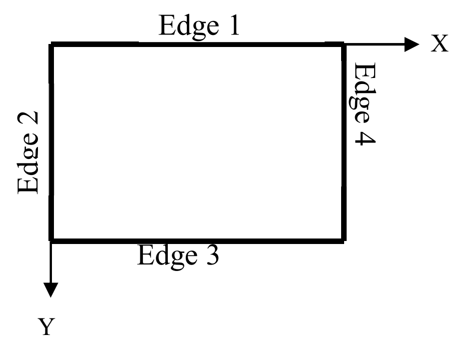


Figure 1.2: Rectangular plate showing the axis and edge numbering.

Plates have various boundary conditions as follows;

i. simply supported

ii. clamp support and

iii. free of support.

The designation and symbol for the edge conditions are as shown in Figure 1.3

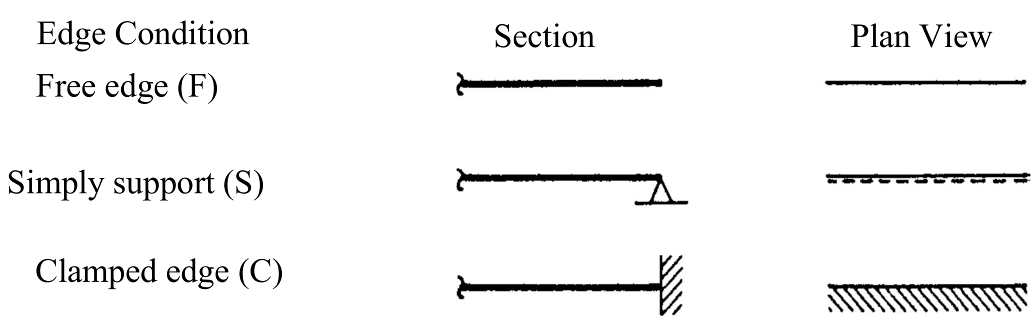


Figure 1.3: Edge conditions of rectangular plate showing sections and plan view

These boundary conditions can be combined to formulate plates with different boundary conditions as shown in Figure 1.4.

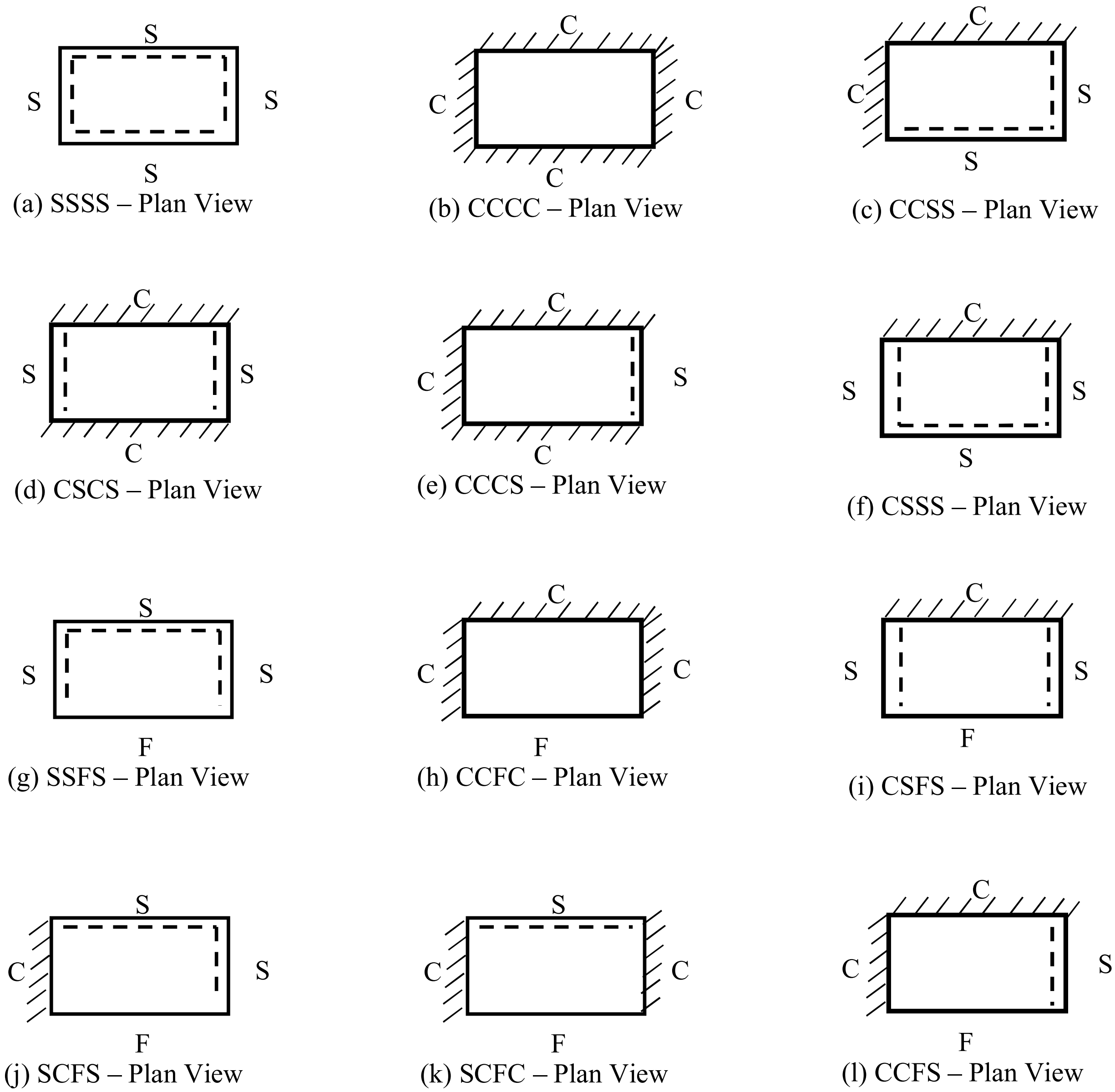


Figure 1.4: Plan view of rectangular plates with various boundary conditions

1.2 Statement of problem

Because of the complexity involved in handling thick anisotropic plates, engineers usually resort to thin isotropic plate or even thick isotropic plate despite the numerous shortcomings. Isotropic plate assumes that the material properties at a point are the same in all directions. However, certain materials display direction-dependent properties; consequently, these materials are referred to as anisotropic materials. When an anisotropic material is stressed in one of the principal directions, the lateral deformations in the other principal directions could be smaller or larger than the deformation in the direction of the applied stress depending on the material properties. Idealization of a thick anisotropic plate as a thin isotropic plate always underestimates the stresses in the plate. The consequence of using these erroneous stresses in design and construction is structural failure and sometimes total collapse. Previous scholars have looked into different aspects of thick plate analysis: Pure bending (Jabareen, Neubauer and Mtanes, 2018; Yang and He, 2018; Sayyad and Ghugal, 2012a, 2012b; Ghugal and George, 2010; Sayyad, Shinde and Ghugal, 2016; Atashipour, Girhammar and Al-Emrani, 2017; Murthy, 1981; Joshan, Grovera and Singhb, 2017a, 2017b; Sahoo and Sigh, 2013, etc), buckling (Fazzolari and Carrera, 2011; Tran *et al.,* 2017; Bouazza *et al.,* 2016; Sahoo and Singh, 2015; Nali, Carrera and Lecca, 2011; Ibearugbulem, Ibeabuchi and Njoku, 2014; Avalos and Larondo, 1995; Kim, Thai and Lee, 2009; Wang, Xiang and Chakrabarty, 2001; Yang and He, 2018; Sreehari and Maiti, 2016; Kazemi and Verchery, 2016; Narayana, Kumar and Rao, 2018; etc), one common observation is that most of these works are based mainly on trigonometric and assumed displacement functions. It is rare to see work on anisotropic thick plate analysis that determined the exact polynomial shape function from the integration of governing equation of equilibrium and compatibility equations of thick anisotropic plate. Earlier works on anisotropic thick plates had relied on assumed displacement functions (which are mainly trigonometric). Thus, it can be said that earlier works on bending analysis of thick anisotropic plates have yielded approximate results, since it cannot be said that the displacement functions used are exact. The need to approach anisotropic thick plate analysis from the perspective of determining the exact displacement functions through integration of the governing equation prompted the present study. This inability to arrive at the exact displacement function has been identified as a gap in literature that has to be filled up. To cover this gap in anisotropic thick plate analysis is the primary motivation of the present study.

1.3 Objectives of study

The main objective of this study is to analyze thick anisotropic plate through exact approach using third order shear deformation theory. The specific objectives are:

i. To formulate the total potential energy functional for a thick anisotropic rectangular plate using third order shear deformation theory.

ii. To formulate the governing equation of equilibrium of forces and two compatibility equations of thick anisotropic rectangular plate.

iii. To formulate the exact polynomial displacement functions and the stiffness coefficients for various plates.

iv. To develop formulas for determining the displacements and stresses.

v. To perform numerical analyses of typical thick anisotropic rectangular plates with different boundary conditions.

1.4 Justification of study

Recently there have been progressive interest in the solution of anisotropic thick plate problems due to the development of high performance fiber reinforced composite materials for structural applications. Many scholars have used double Fourier series integration to obtain solutions for bending, buckling, and vibration of nonhomogeneous, or symmetrically laminated anisotropic plate with various boundary conditions. This approach is quite demanding and involving, unlike the approach of using orthogonal polynomial. The use of orthogonal polynomial in the third order theory eliminates the difficulties associated with the use of double or single Fourier series in analyzing thick anisotropic plates.

This third order shear deformation theory through exact approach contribute in addressing the inadequacy of literature in this field. Hence, scholars and practicing engineers now have easy access to this method and also have confident in their works and designs.

The orthogonal Polynomial displacement functions are easily used to adapt peculiar displacement function for rectangular plate of any boundary condition. This feat has before now proved daunting using trigonometric shape functions. The work eliminates the doubt of not being too sure of one's work using Fourier series to analyze thick plates and at the same time boost the confidence of the engineer, since he/she is sure of obtaining good results without difficulty. It generates financial benefit to engineers since they now have easier and better approach which can be handled by many engineers rather than contracting it to few knowledgeable experts.

1.5 Scope of study

This study concentrated on thick rectangular anisotropic plates. The analysis was based on third order thick plate theory and assumptions. Ritz energy method was used for the analysis. The solution derived the general orthogonal polynomial displacement functions for a rectangular plate from the governing equation and compatibility equations of a rectangular thick anisotropic plate based on third order shear deformation theory. Deflection at the center of the anisotropic rectangular plate was determined for various angles fiber orientation (0^0, 15^0, 30^0, 45^0, 60^0, 75^0 and 90^0), various span to thickness ratios, α (5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100) and for all the twelve boundary conditions illustrated in figure 1.4, namely:

i. SSSS - all four edges simply supported
ii. CCCC - all four edges clamped
iii. CCSS - adjacent edges clamped and the other adjacent edges simply supported
iv. CSCS - opposite edges clamped and the other opposite edge simply supported
v. CCCS - three edges clamped and one edge simply supported
vi. CSSS - one edge clamped and the other three edges simply supported
vii. SSFS - free of support at one edge and the other three edges simply supported
viii. CCFC - free of support at one edge and the other edges clamped
ix. CSFS – clamped at one edge, simply supported at two edges and free of support at one edge
x. SCFS - simply supported at two edges, clamped at one edge and free of support at one edge
xi. SCFC simply supported at one edge, clamped at two edges and free of support at one edge
xii. CCFS - clamped at two edges, free of support at one edge and simply supported at one edge.

In-plane displacements (u and v), in-plane stresses (σ_x, σ_y and τ_{xy}) and out-plane stresses (τ_{xz} and τ_{yz}) were also determined for the same angles of orientation of fibers, span-depth-ratios and boundary conditions as applied to central deflection. Finally, a functional excel worksheet program was developed for easy analysis of thick anisotropic plates.

CHAPTER TWO

LITERATURE REVIEW

2.1 Classification of Plates

Plates may be classified into three groups according to the side “a” to thickness “t” (or “h”) ratio. These groups are;

i. Plates that have side to thickness ratio less than or equal to 10 ($^{a}/_{t} \leq 10$): This class is regarded as thick. Its analysis includes all the components of stresses, strains, and displacements as for solid bodies, using the general equations of three-dimensional elasticity.

ii. Plates that have side to thickness ratio greater than or equal to 100 ($^{a}/_{t} \geq 100$): this class is referred to as membranes and they don’t possess flexural rigidity. They also carry the lateral loads by axial tensile forces N (and shear forces) acting in the plate middle surface. These forces, which produce projection on a vertical axis and thus balance a lateral load applied to the plate membrane are called membrane forces.

iii. Plates that have side to thickness ratio greater than 10 but less than 100 are classified as thin. Plate can also be classified as stiff or flexible depending on the ratio of the maximum deflection to its thickness.

a. Stiff plates: When the ratio of maximum deflection to thickness is less than or equal to 0.2 ($^{w}/_{t} \leq 0.2$) the plate is classified as stiff plate. They are flexural rigid plates, which carry loads in two dimensions, mostly by internal bending and twisting moments and by transverse shear forces. In stiff plate, the middle plane deformations and the membrane forces are negligible. Unless otherwise specified, in engineering practice, the term plate is understood to mean a stiff plate. A fundamental feature of stiff plates is that the equations of static equilibrium for a plate element may be set up for an original (un-deformed) configuration of the plate.

b. Flexible plates: On the other hand, when the ratio of maximum deflection to the thickness ratio is greater than or equal to 0.3 ($^{w}/_{t} \geq 0.3$) the plate is classified as flexible plate. Cases like this occur mainly when the lateral deflections will be accompanied by stretching of the middle surface. These plates represent a combination of stiff plates and membranes and carry external loads by the combined action of internal moments, shear forces, and membrane (axial) forces. This class of plate is widely used by the aerospace industry because of their lower weight to load ratio. The membrane action predominates each time the magnitude of the maximum deflection is considerably greater than the plate thickness. If w/t > 5, the flexural stress can be neglected compared with the membrane stress. Consequently, the load-carrying mechanism of such plates becomes of the membrane type, that is, the stress is uniformly distributed over the plate thickness.

The above classification is, of course, conditional because the reference of the plate to one or another group depends on the accuracy of analysis, type of loading, boundary conditions, etc.

2.2 Classical and refined theories of rectangular plates

The major classification of plate theories are classical and refined plate theory. Thin plates are analyzed based on classical plate theory, while thick plates are analyzed based on refined plate theories (Sayyad and Ghugal, 2012a; Zenkour, 2013; Szilard, 2004; Reddy, 2007; Ibearugbulem, 2016). Authors like, Kirchhoff (1850), Mindlin (1951), Pagano (1970), etc, used classical theory in rectangular plate analysis while others like, Reddy(1984), Sayyad and Ghugal(2012), Joshan *et al.*(2017), present study, etc, used refined theory in rectangular plate analysis. Unlike classical plate theory, refined plate theory are more demanding, thus, will require more time when used for analysis but gives more reliable results.

2.2.1 Classical plate theory

The classical plate theory is based on small displacement plate theory. The pioneer authors to the classical plate theory were Kirchhoff (1850), Love (1888) and Rayleigh (1894). Their works were modelled to the widely known love-Kirchhoff's theory of plate, which does not carter for shear deformations and is only limited to thin plates. This theory models the laminates as a two dimensional single layer by ignoring the three transverse strain components and the transverse normal stress components (Kazanci, 2016). According to Iyengar (1988), Ugural (1999), Ventsel and Krauthammer (2001), Szilard (2004) and Ibearugbulem (2016), the Kirchhoff's classical plate theory is summarized as follows:

i. The plate material is elastic, homogenous and isotropic.

ii. The plate is flat (not bent) before loading.

iii. The out of plane displacement (w) of the middle surface of the plate is small when compared with the thickness of the plate. That is $w/t < 0.3$. This implies that membrane stresses are negligible and that the plate resists bending mainly by its bending stiffness.

iv. The middle surface of the plate shall neither stretch nor compress before, during or after bending. That is, the middle surface of the plate is the neutral surface (surface of zero stress).

v. The stress normal to middle surface, σ_z is assumed to be zero.

vi. A vertical section that is initially straight and normal to the middle surface before bending shall remain straight and normal to the middle surface after bending. This implies that the out of plane shear strains are zero $(\gamma_{xz} = \gamma_{yz} = 0)$; that is, zero rotation of the vertical section relative to the middle surface. As the vertical section is rotating, the middle surface is also following it with the same magnitude. Thus, there is no relative rotation of the vertical section to the middle surface. This assumption defines the boundary between thin plate and thick plate.

The above summary was restricted to thin plates or plates whose elastic modulus to shear modulus ratios is not very large. This is because the transverse strains and transverse stresses were ignored.

2.2.2 Refined plate theory

Refined small displacement plate theory adopts virtually all the Kirchhoff's assumptions except the sixth one. In refined plate theory, the vertical shear strains are not zero and that is why the vertical section that is initially straight and normal to the middle surface before bending no longer remains normal to the middle surface after bending. Consequently, there is relative rotation of the vertical section to the middle surface. Hence, the existence of vertical shear strains after bending (Ibearugbulem, 2016). Nevertheless, in order to describe accurately the bending behavior of thick plates including shear deformation effects and the associated cross sectional warping, shear deformation theories are required. This can be accomplished by selection of proper kinematics and constitutive models (Thai and Vo, 2013; Shimpi and Patel, 2006). Therefore, the main difference between classical plate theory and shear deformation theory is the inclusive of the effect of transverse shear in predicting the bending, frequency and buckling behavior of plates. Since the transverse shear deformation is neglected in classical plate theory, it cannot be applicable to thick plates where effects of shear deformation are more significant. Thus, its suitability is limited to only thin plates.

However, in refine plate theory, the vertical shear strains are not zero. Significant transverse shear strains occur, and the theory gives inaccurate results for the plates. So, it is obvious that the shear strains have to be taken into account. However, increasingly many engineering applications, such as bridge deck require the use of thick-walled structures where significant traverse shear strain occurs, for which the Kirchhoff's Classical Plate Theory is inadequate because it underestimates deflections and overestimates vibration frequencies and buckling loads (Sayyad *et al.,* 2013). A thorough understanding of the dynamics of thick-walled structures that will take into account of the shear strains is therefore helpful to an efficient design.

2.3 Shear deformation in plate analysis

The shear deformation effects are more pronounced in thick plates subjected to transverse loads than in thin plates under similar loading (Sayyad and Ghugal, 2012a, 2012b; Touratier, 1991; Chaudhurt, 2005). A number of shear deformation theories have been developed by several researchers to address the inadequacy of using classical plate theories (Reissner, 1945; Mindlin, 1951; Reddy and Liu, 1985; Soldatos, 1992; Karama *et al.*, 2003; etc.). The shear deformation theories aimed at predicting accurately the structural behavior of thick plates, for which classical plate theories are inadequate. These shear deformation theories were deduced from Kirchhoff's biharmonic equation on thin plates, in order to propose a correction on the biharmonic expression that will include the effect of shear deformation. These theories include first order shear deformation and higher order shear deformation theories.

2.3.1 Previous work on first order shear deformation theory (FSDT)

First-order shear deformation theory (FSDT) was developed to overcome the limitations of classical plate theory, which ignores the transverse shear and transverse normal deformations. Several authors have used this theory to solve structural problems of thin, moderately thick, laminated anisotropic and orthotropic composite plates. Reddy and Arciniega (2004) reviewed the theories of shell and shear deformation of plates. Auricchio and Sacco (2003) presented a first-order shear deformation theory from mix variational formulations, which does not require shear correction coefficients. Whitney (1973), Noor and Burton (1989) and Pai (1995) used the shear correction coefficients to develop the first-order shear deformation theory. Ghugal and Shimpi (2002) presented a review of refined shear deformation theories of isotropic and anisotropic laminated plates. Reissner (1944, 1945) presented the theory of bending of elastic plates and the effect of transverse shear deformation on the bending of elastic plates. Auricchio and Sacco (2003) developed new mix first-order shear deformation theory models for composite laminates, which does not require shear correction coefficients. Mantari and Ore (2015) used a simplified FSDT to analyze the free vibration of single and sandwich laminated composite plates. Reissner (1945) and Mindlin (1951) developed the FSDT after studying the effect of transverse shear in the deformation of plates. However, FSDT needed a shear correction factor for accurate prediction of the transverse shear stress developed on the plate edge. This shear correction factor is very difficult to compute because it depends on parameters like lamination sequence, boundary condition, etc. (Pai, 1995; Khdeir, 1989; Joshan *et al*., 2017).

2.3.2 Previous works on higher order shear deformation theories (HSDT)

The non-isotropic nature of the laminated anisotropic composite has made researchers and engineers to adopt the shear deformation effect in the design and analysis of structures. In order to overcome the shortcomings of classical plate theory and FSDT, HSDT was developed (Joshan *et al*., 2017; Sahoo and Sigh, 2013; Kazanci, 2016; Bouazza, Kenouzaa, Benseddiqe, Ashraf and Zenkourd, 2017). Reddy (1984) formulated a high order shear deformation theory of laminated composite plate which also have the same unknown dependent variables as the first-order shear deformation theory of Whitney and Pagano (1970). Aydogdu (2006) reviewed different shear deformation theories for the static and dynamic analysis of laminated composite plates. Phan and Reddy (1985) used a higher-order shear deformation theory, which does not require shear correction coefficients to solve laminated anisotropic composites plates. Whitney and Sun (1973) formulated refined laminated plate theory that can be applied to fiber reinforced composite materials under impact loading. Lan and Feng (2012) used a third-order shear deformation theory to solve the deflections and stresses of the simply supported symmetrical laminated composite plates. Bessenghier, Houari, Tounsi and Mahmoud (2016) used non-local trigonometric shear deformation theory to analyze free vibration of embedded functional graded nano-size plates, which are resting on elastic foundation. Kant and Pandya (1988) formulated a higher-order finite element theory for unsymmetrically laminated composite plates. Chikh, Hebali, Tounsi and Mahmoud (2017) used a simplified HSDT to analyze the thermal buckling of cross ply laminated plates. Boukhari, Atmane, Tounsi, Bedia and Mahmoud (2016) developed an efficient shear deformation theory for wave propagation of functionally graded material plates.

Belifa *et al*. (2016) analyzed the bending and free vibration of functionally graded plates using a simple shear deformation theory and the concept of the neutral surface position. Grover et al. (2013) formulated a new inverse hyperbolic shear deformation theory for static and buckling analysis of laminated composite and sandwich plates. Mahi, Bedia and Tounsi (2015) developed a new hyperbolic shear deformation theory for bending and free vibration analysis of isotropic functionally graded, sandwich and laminated composite plates. Yahia, Atmane, Houari and Tounsi (2015) used various higher-order shear deformation plate theories to solve for wave propagation in functionally grade plates with porosities. Merdaci, Tounsi and Bakora (2016) formulated a novel four variable refined plate theory for laminated composite plates. Wu and Hsu (1993) developed a new local higher-order laminated theory of composite plates. Mantari, Oktem and Soares (2012) formulated a new higher order shear deformation theory for sandwich and composite laminated plates. Ganapathi, Patel and Makhecha (2004) used an accurate higher-order theory to analyze nonlinear dynamic thick composite plates. Matsunaga (1992) analyzed a thick elastic plate by the application of a two-dimensional higher-order theory. Cho and Kim (1996) used displacement fields of higher order plate theories to formulate the matching technique of post-process method. Khdeir and Reddy (1989) developed the exact solution for the transient response of symmetric cross-ply laminates by using a higher-order plate theory.

2.3.3 Previous works on layer-wise lamination theory (LLT)

Layer-wise lamination theory assumes a displacement representation formula in each layer which can predict accurately the inter-laminar stresses (Kazanci, 2016). Carrera and Demasi (2002) used the Reissner mixed variational theorem to study the accuracy of the finite-element mixed layer-wise solutions. Carrera (2003) presented the historical review of zig-zag theories for multi-layered plates and shells. Carrera (1998) evaluated the layerwise mixed theories for laminated plate analysis. Desai *et al*. (2003) developed a layer-wise finite element model, which he used for dynamic analysis of laminated composite plate. Plagianakos and Saravanos (2009) developed a higher order layer-wise lamination theory for the prediction of inter lamina shear stresses in thick and sandwich composite plates. Mantari and Soares (2013) presented a generalized layer-wise HSDT and the finite element formulation for symmetric laminated and sandwich composite plates. Nosier *et al*. (1993) formulated a layer-wise theory, which was later used for free vibration analysis of laminated plates.

In layer-wise model, the number of unknown functions depends on the layers of the laminates. Hence, it is computationally expensive.

2.3.4 Previous works on zig-zag theory (ZZT)

Zig-zag theories were developed in order to overcome the lengthy computational time experienced in layer-wise theories,. Tremendous achievement in this field was accomplished by Di Sciuwa (1984). He proposed a refined zigzag plate theory, in which the unknowns for the in-plane displacements at each layer were assumed in terms of those at the reference plane and the transverse displacement was assumed constant along the plate thickness (Di Sciuwa, 1986; Kazanci, 2016). Carrera (2003) reviewed the zig-zag theories for multi-layered plates and shells. Liu and Li (1996) and Murakami (1986) improved the Di Sciuwa refined zig-zag plate theory. A new inverse trigonometric zig-zag theory was formulated by Sahoo and Sing (2013) which they used to solve for the static analysis of laminated composite and sandwich plates. Versino, Gherlone, Mattone, DiSciuva and Tessler (2013) presented a refined zig-zag theory for multilayered composite and sandwich plates, which does not require shear deformation coefficient to yield accurate results. Lee, Senthilnathan, Lim and Chow (1990) developed an improved zig-zag model for the bending of laminated composite plates.

Just like its name zig-zag, calculations are always not in orderly form.

2.3.5 Previous works on 3D elasticity theory

Srinivas, JogaRao and Rao (1970) presented a free vibration of simply supported, homogeneous isotropic and laminated thick rectangular plates using 3D linear, small deformation theory of elasticity. This solution was later extended for the bending, vibration and buckling of simply supported thick orthotropic rectangular plates and laminates (Srinivas and JogaRao, 1970). Kulikov and Potnikova (2012) developed the exact 3D stress of laminated composite plate by sampling surface method. Noor (1973) presented the free vibration analysis of multilayered composites plates. Pagano (1969, 1970) developed the exact solutions for composite laminates in cylindrical bending and for rectangular bidirectional composite and sandwich plates. Loredo (2014) studied the exact 3D solution for static and damped harmonic response of simply supported general laminates.

3D elasticity theory is an efficient method, which can predict inter lamina stress of a composite laminate but requires lengthy computational time.

2.4 Polynomial Shape Function

Several authors like Murthy (1981); Shames and Dym (1991); Shimpi and Patel (2006); Sayyad and Ghugal (2012a, 2012b); Chikalthankar *et al.* (2013); Sandrnejad, Daryan and Ziaei (2009); Szilard (2004); Hashemi and Arsanjani (2005); Reddy (2014) and Daouadji, Tounsi, Bedia and Abbes (2013) used trigonometric shape functions in the form of double Fourier series to approximate the deformed shapes of thick plates. However, the double Fourier series has one major disadvantage when approximating the eigenvalues of rectangular plates. Only the principal eigenvalue can be evaluated due to the orthogonal properties of trigonometric functions. Hence, only the principal stresses and strains will be obtained accurately. It can be stated here that the accuracy of approximation of the Ritz method, Galerkin method and any other weighted residual (approximation) method depend upon the quality, the completeness and the closeness of the shape functions to the exact solution. The calculations and integrations in double Fourier series are very tedious, involving and quite demanding. Hence, the need for an easy, simplified and more accurate approach of solving thick plate problems. Thus, orthogonal polynomial shape function using third-order shear deformation offered an easier and more accurate approach for thick plate analysis.

Generally, the use of polynomial displacement functions offered the following advantages:

i. The differentiation and integration of polynomial displacement functions are quite easy and accurate

ii. Polynomial displacement functions can be used successfully to solve any boundary condition of thick rectangular plate.

iii. Polynomial displacement functions as shape functions can be easily applied to approximate solution of problems of linear and nonlinear cases.

The use of polynomial functions is lately becoming popular in solving plate problems. Abedi, JAFARI-talookolaei and Valvo (2016) employed legendre polynomial as the base functions to analyze the free vibration of rectangular laminated composite plates. Bhat (1985) used characteristic orthogonal polynomials to evaluate the natural frequencies of rectangular plates. Sahoo and Singh (2013) applied a higher order polynomial function to solve static laminated composite plate. In addition, Ibearugbulem (2012) employed Taylor-Maclaurin series to formulate shape functions for plate problems. Murthy (1984) studied the consistency of beam theory using polynomial shear deformation function. His shape function is given as shown in Equation (2.1):

$$f(z) = z\left[1 - \frac{4}{3}\left(\frac{z^2}{h^2}\right)\right] \tag{2.1}$$

Ambartsumian (1958) applied polynomial shear deformation function to study pure bending analysis of thick plates. His shear deformation function is given as shown in Equation (2.2):

$$f(z) = \frac{z}{2}\left[\frac{h^2}{4} - \frac{z^2}{3}\right] \tag{2.2}$$

Others have applied polynomial displacement functions in numerical methods like finite element methods and differential quadrature elements methods (Goswami and Becker 2013; Liu, 2000; Matikainen, Schwab and Mikkola, 2009).

2.5 Exact approach as opposed to approximate approach.

Exact approach requires a lot of computational time. The method is more difficult since it requires derivation of every values that will be needed in the solution from the scratch. However, it is more trustworthy and yield accurate solutions and values. Exact approach can takes a lot of computational time when applied to methods like Garlekin, Navier, Rayleigh, etc.

In the study of periodic motion and theory of oscillations where an equation contains two terms such as principal and secondary terms, the secondary terms are always made up of small constant factors or parameters while the principal term has the other parameters. Dropping the secondary terms will yield equation of exact solution while the solution of the original equation can be obtained as a series with its first term as a solution of equation without the secondary terms.

Approximate solution entails solving a particular problem by choosing approximate values that will facilitate the quick arrival to the solutions. An approximate solution to a problem say for instance an analytic expression can compute through the method of series, the method of small parameters, chaplygin method, Ritz and Galerkin methods. All of these methods explains infinite processes and sometimes can be used to derive an exact solution of a problem. However, if a solution is represented as an infinite series, a finite part of the series can be assumed to be approximate solution.

2.6 Similar works on higher order shear deformation theories (HSDT)

Several works have been done on higher order shear deformation theories. Rakocevic, Popovic and Ivanisevic (2017) presented a new computational method for stress-strain analysis of simply supported rectangular cross-ply laminated composite plates subjected to transverse loads. They developed a Fortran program code, which the algorithm was based on the layer-wise theory of Reddy. Double trigonometric series were employed to solve the equations obtained by applying the principle of virtual displacements. The convergence and numerical stability of the output variables depend on the changes in the ratio of side to thickness b/h and modulus ratio E_1/E_2. Thus, increase in the ratio of b/h introduces numerical instability to the displacement of the solution. This instability starts from b/h > 5 and grows to infinity when b/h = 40 and above. They attributed the cause of the instability to the accumulation of numerical errors and suggested introduction of additional conditions for displacement v on the edge y = 0. Also in the cases of higher aspect ratio of the plate a/b and cases of small values of the modulus ratio E_1/E_2, the coefficient matrix obtained by applying the equation shown is singular. Thus, the value of output variables cannot be obtained.

Shinde, Sayyad and Ghumare (2015) used refined trigonometric shear deformation of Equation (2.3) to investigate bending analysis of isotropic and orthotropic plates under various loading conditions.

$$\begin{bmatrix} K & K^j \\ K^{j^T} & K^{ji} \end{bmatrix} \begin{Bmatrix} X_{mn} \\ Y_{mn} \\ W_{mn} \\ R^J_{mn} \\ S^J_{mn} \end{Bmatrix} = \begin{Bmatrix} 0 \\ 0 \\ Q_{mn} \\ 0 \\ 0 \end{Bmatrix} \tag{2.3}$$

Their theory involved two unknown variables and also satisfied the shear stress free condition at top and bottom surface of the plates without using shear correction factors. They employed the principle of virtual work to determine the governing equations and boundary conditions. They got closed form solution from Navier Solution Scheme. The theory analyzed a simply supported isotropic and orthotropic plate subjected to sinusoidal distributed, uniformly distributed and linearly varying loads for the detailed numerical study. The results obtained were compared with previously published results. Gunjal, Hajare, Sayyad and Ghodle (2015) employed a refined trigonometric shear deformation plate theory for the buckling analysis of thick isotropic square and rectangular plates. The theory involves only two unknowns, as against three in first order shear deformation theory and other higher order theories. The theory also involves sinusoidal function in the in-plane displacement. They used transverse displacement that accounted for bending and shear components. They applied the principle of virtual work to derive the governing equations and boundary conditions of the theory. A case of simply supported isotropic rectangular plate subjected to uniaxial and biaxial compression were evaluated. Their results for critical buckling load of simply supported isotropic rectangular plates agreed with those of other refined theories.

Chen and Doong (1984) presented the buckling of clamped circular plates subjected to arbitrary loading condition. They employed the Galerkin method to derive the governing equations and found that bending stress has significant effect on the buckling load. Kant and Swaminathan (2002) investigated analytical solutions for the static analysis of laminated composite and sandwich plates based on a higher order refined theory composite structures. They formulated a model to incorporate laminate deformations, which accounted for the effects of transverse shear deformation, normal strain/stress and non-linear variation in-plane displacement with respect to the thickness coordinates. Chen and Doong

(1983) investigated the vibration of circular Mindlin plates from rectangular Mindlin plates. They studied the axisymmetric vibration of an initially stressed bi-modulus thick circular plate.

Fazzolari and Carrera (2011) presented advanced variable kinematics that uses Ritz and Galerkin formulations for accurate buckling and free vibration analysis of anisotropic laminated composite plates. They derived the approximation methods of Rayleigh-Ritz, Galerkin and Generalized Galerkin, based on Principle of Virtual Displacement. This was used both for the same and different expansion orders, for the displacement components, in the thickness layer-plate direction. They carried out buckling analysis of the cross-ply and regular symmetric angle ply with respect to uniaxial, biaxial and pure shear loads. They employed Von Karman's approximation and exact nonlinear strain-displacement relations together with preloads corresponding to a constant stress state. They also provided an extensive assessment of advanced and refined plate theories, which include Equivalent single Layer, Zig-Zag and Layer-wise models, with increasing number of displacement variables. However, the solution is rigorous, time demanding and involve lengthy computer programming to achieve result. Gupta and Ansari (1998a) employed classical plate theory to investigate asymmetric vibrations of polar orthotropic circular plates of linearly varying thickness subjected to hydrostatic in-plane force. They used functions based on static deflection of polar orthotropic circular plates to obtain an approximate solution through the Rayleigh-Ritz method. Wang and Aung (2007) applied Ritz method to investigate plastic buckling analysis of thick plates. In-order to allow for the effect of transverse shear deformation in thick plate, they adopted Mindlin plate theory. They studied the plastic buckling behavior of the plate by applying the incremental and deformation theory of plasticity. After which they determined the governing eigenvalue equation for the plastic buckling of uniformly stressed plates with edges defined by polynomial functions by applying the Ritz method. They approximately represented the displacement functions of the plate by the product of mathematically complete two dimensional polynomial function. They also raised the boundary equations to appropriate power that ensures the satisfaction of the geometric boundary conditions.

Daouadji *et al*. (2013) used higher-order shear deformation theory of the static response of functionally graded plate to investigate a new displacement function. The theory presented a shape functions f(z) for determining the distribution of the transverse shear strain and stresses along the thickness as shown in Equation (2.4):

$$f(z) = \mathrm{z} - \left[z\, \mathrm{s} \sec h\left(\frac{\pi z^2}{h^2}\right) - z \sec h\left(\frac{\pi}{4}\right)\left(1 - \frac{\pi}{2}\tan h\left(\frac{\pi}{4}\right)\right)\right] \tag{2.4}$$

Contrary to the first order shear deformation theory it does not require shear correction factor. Their transverse shear stresses varied parabolically across the thickness, satisfying shear stress free surface conditions. They assumed the mechanical properties of the plate to vary continuously in the thickness direction by a simple power-law distribution in terms of the volume fractions of the constituents. Parametric studies were performed for varying ceramic volume fraction, volume fraction profiles, aspect ratios and length to thickness ratios. The accuracy of the theory was investigated by comparing some of the obtained results with those of the classical, the first-order and higher-order theories and found that the proposed theory was accurate and simple in solving the static behavior of functionally graded plates. Badaghi and Saidi (2010) used analytical approach for buckling analysis of thick functionally graded rectangular plates. They applied higher order shear deformation plate theory to determine equilibrium and stability equations. The coupled governing stability equations of functionally graded plate were converted into two uncoupled partial differential equations in terms of transverse displacement and a new function, called boundary layer function by analytical method. They used Levy-type solution to solve for the functionally graded rectangular plate with two opposite edges simply supported under different types of loading conditions. The accuracy of the analytical solution was confirmed by making some comparisons of the present results with those available in the literature. Furthermore, they carried out detailed studies and discussion of the effects of power of functionally graded material, plate thickness, aspect ratio, loading types and boundary conditions on the critical buckling load of the functionally graded rectangular plate. Their result were first to show the critical buckling loads of thick functionally graded rectangular plates with various boundary conditions; hence, it can be used as benchmark.

Li and Narita (2013) studied the vibration of supersonic laminated plates with general edge conditions. They employed the optimal fiber orientation angles of supersonic laminated plate by using a layer-wise optimization approach and also considering the thermal effect to obtain the maximum critical aerodynamic pressure. They observed from their results that the first critical flutter modes are different for different edge conditions of supersonic plates and in some cases with the increase of aerodynamic pressure the buckling occurs before the flutter. Sayyad *et al*. (2013) applied trigonometric shear deformation theory to study bending and free vibration analysis of thick plates. They used in plane displacement field together with sinusoidal function in terms of thickness coordinate. This accounts for realistic variation of the transverse shear stress through the thickness and satisfies the shear stress free surface conditions at the top and bottom surfaces of the plate. Unlike the first order or equivalent shear deformation theories, this theory does not apply shear correction factor. They considered a simply supported thick isotropic plate for detail numerical study. Also Navier's solution technique was employed for their analytical solution. The results obtained for displacements, stresses and natural bending mode frequencies were compared with those of other refined theories and exact solution from theory of elasticity.

Kumar, Raju and Reddy (2011) used higher order shear displacement model with zigzag function to formulate an analytical procedure which they employed to investigate the free vibration characteristics of different laminated composite plates. As the number of layers increases, fundamental frequencies increases, thus the extensional coupling effect decreases without changing the total thickness. This effect of the number of layers was most pronounced for angle-ply laminated plates. Their work showed that coupling between bending and stretching had a significant effect on the behavior of anti-symmetric laminates with few Lamina. Ivo *et al.* (2013) developed a new approach for evaluating the properties of thick plates by employing Mindlin theory of thick plate. They used bending deflection as a potential function to define pure bending deflection and shear deflection with bending angles of rotation, and in-plane shear angles. Based on this modified approach, they developed rectangular shear locking-free finite element for determining flexural vibrations. Using finite element method and evaluating analytically they obtained results, which are in good agreement with other results from relevant literature.

Sayyad and Ghugal (2012b) employed exponential shear deformation to study the buckling of thick isotropic plates subjected to uniaxial and biaxial in-plane forces. The theory, which does not require shear correction factor, accounted for a parabolic distribution of the transverse shear strains across the thickness and satisfied the zero traction boundary conditions on the top and bottom surfaces of the plate. They used dynamic version of the principle of virtual work to obtain the governing equations and boundary conditions of the theory. The simply supported thick isotropic square plates were considered for the detailed numerical studies. A closed form solutions for buckling analysis of square plates was obtained. The results obtained by using proposed theory were found to be in good agreement with the exact elasticity results. Joshan *et al*. (2017) formulated a new non-polynomial shear deformation theory having four variables which they assessed for hygro-thermo-mechanical response of laminated composite plates. They used an inverse hyperbolic function of thick coordinate in the displacement field when considering the shear deformation effect. The governing equations for the cross-ply plates which they employed axiomatic approach to resolve were derived from the principle of virtual work theory. Navier type closed form solution was employed to solve the developed governing equations for simply supported boundary conditions. This new non-polynomial shear deformation theory, which possesses only four variables was achieved by incorporating the integrals of the shear rotation in the in-plane displacements. Their theory satisfies the traction free boundary conditions as a priori and does not require shear correction factor. However, the computing takes a lot of time, energy and finance.

Raju and Kumar (2011), based on higher order shear displacement model with zig-zag function, developed an analytical procedure that was used to investigate the bending characteristics of laminated composite plates. This zig-zag function improves slope discontinuities at the interfaces of laminated composite plates. They applied the dynamic version of Hamilton's principle to obtain the equation of motion. The solutions were obtained using Navier's and numerical methods for anti-symmetric cross-ply and angle-ply laminates with a specific type of simply supported boundary conditions. Jam et al. (2012) used generalized differential quadrature (GDQ) to investigate linear and non-linear bending analysis of moderately thick functionally graded (FG) rectangular plates with different boundary conditions. They assumed the modulus of elasticity of plates to vary according to a power law distribution in-terms of the volume fractions of the constituents. They employed first order shear deformation theory and Von Karman type non-linearity, to obtain the governing system of equations, which includes a system of thirteen partial differential equations (PDE) in terms of unknown equations. A simple procedure to satisfy different boundary conditions was provided in the presence of all plate variables in the governing equations. The generalized differential quadrature (GDQ) technique which were successively applied to the governing equations resulted in a system of non-linear equations. The resulting system of non-linear equations were solved by applying Newton-Raphson iterative method. The accuracy of the obtained results for both displacement and stress components were compared with those of analytical and finite element methods and found that the theory can predict accurately the displacement and stress components even for small number of grid points. Sahoo and Singh (2013) presented a new inverse trigonometric Zigzag theory which they used for the static analysis of laminated composite and sandwich plates. Their theory employed a higher order displacement field across the plate thickness to satisfy the continuity conditions at the layer interfaces. It also fulfilled the need for shear correction factor by satisfying transverse shear stress continuity conditions at layer interfaces and tangential stress-free boundary conditions on the plate boundary surface. The developed efficient C^0 finite element model was assumed to investigate the static response of laminated and sandwich plates. The theory assumes a realistic non-linear distribution of transverse shear stresses on the surface of the plate and it considers same number of unknowns as of FSDT, making it computationally sound. However, the thick plates (i.e. for a/h = 2-5) are observed to possess much higher transverse deflections compared to moderately thick to thin plates (i.e. for a/h = 10-100) for each boundary condition. They attributed the deficiency to the effect of transverse flexibility of the core and shear deformation, which are more pronounced in thick plates compared to thin plates.

Sayyad and Ghugal (2014) used exponential shear deformation theory to study the buckling and free vibration analysis of orthotropic plates. Natural frequencies and critical buckling loads of orthotropic plates were obtained. The theory does not require coordinate correction factors and therein solves for a parabolic distribution of the transverse shear strain across the thickness and satisfies the zero traction boundary conditions on the top and bottom surfaces of the plate. They used exponential function in terms of thickness coordinate which included the effect of shear deformation and rotary inertia in their in-plane displacement fields as shown in Equations (2.5) and (2.6):

$$f(z) = Z\, exp\left[-2\left(\frac{z}{h}\right)^2\right] \tag{2.5}$$

$$g(z) = \text{zexp}\left[\left(-2\left(\frac{z}{h}\right)^2\right)\left(1-4\left(\frac{z}{h}\right)^2\right)\right] \tag{2.6}$$

They employed Navier type solution to solve the governing equations of simply supported square orthotropic plates. The results obtained were in good agreement with the results of past scholars. Tran et al. (2017) presented an isogeometric finite element approach for thermal bending and buckling analyses of laminated composite plates. They developed a six variable quasi-3D model with one additional variable in transverse displacement of higher-order shear deformation theory (HSDT). This model employs the effects of transverse shear and normal strain in a laminated composite plate. Thus, non-zero transverse normal strain is produced by temperature rise in a plate structure. The continuity requirement of their plate model was naturally fulfilled by its geometric analysis, which the governing equation discretized. They considered two kinds of thermal plate issues (thermal buckling and thermal bending phenomena) due to the presence of bending-extension coupling. However, the solution is restricted to purely thermal loading whereas in practical application plates can be subjected to electrical, thermal and mechanical loads combined together. Hashemi and Arsanjani (2004) investigated the exact characteristics equations for some classical boundary conditions of vibrating moderately thick rectangular plates. Based on the Mindlin plate theory they derived the dimensionless equations of motion which was employed to study the transverse vibration of thick rectangular plates without further usage of any approximate method. For plates having two opposite sides simply supported the exact closed form characteristic equations were given within the validity of the Mindlin plate theory. Six distinct cases were considered, including all possible combinations of classical boundary conditions at the other two sides of rectangular plates. Accurate eigen-frequency parameters were presented for a wide range of aspect ratio (g) and thickness ratio (d) for each case. They presented three dimensional deformed mode shapes together with their associated contour plots obtained from the exact closed form eigen-functions. They also investigated the effect of boundary conditions, aspect ratios and thickness ratios on the eigen-frequency parameters and vibratory behavior of each distinct case. Xiang (2002) employed Mindlin plate theory to investigate the vibration behavior of circular Mindlin plates with multiple concentric ring supports. He obtained the first known exact vibration frequencies for circular Mindlin plates with multiple concentric ring supports by dividing a circular plate into multiple annular segments and a circular segment at the location of the ring supports. He also studied plate boundary conditions and the influence of the ring support locations and plate thickness ratios on the vibration behavior of circular plates.

Damnjanovica, Nefovska-Danilovica, Petronijevica and Marjanovica (2017) applied dynamic stiffness method in the vibration analysis of stiffened composite plates. They applied dynamic stiffness method to predict free vibration characteristics of composite plate assemblies in mid and high frequency ranges. This dynamic stiffness method comprises of dynamic stiffness element and its dynamic stiffness matrix, which is derived from exact solution of the governing equations of motion in the frequency domain. Although the solution was developed to overcome the shortcomings of finite element method, the computing is very tedious, time consuming and expensive. Chinosi, Croce, Cinefra and Carrera (2016) approximated the mechanical response in anisotropic multilayered plates through Reisnner mixed variational theorem (RMVT) and mixed interpolated tensorial components (MITC) elements, with particular attention to the behavior along the thickness of the plate. They formulated two variational techniques to calculate the stiffness matrix, namely, the Principle of Virtual Displacement (PVD) and the Reissner Mixed Variational Theorem (RMVT). They adopted a strategy similar to MITC approach in the RMVT formulation and assumed the transverse stresses as independent variables. Their displacement field is defined according to Reisnner-Mindlin theory and their shear stresses are assumed parabolic along the thickness by means of RMVT. However, their developed method showed successful performances in approximating the solutions of the structures but does not compute the normal stain ε_{zz} and normal stress σ_{zz} in z directions.

Bouazza, Lairedj, Benseddiq and Khalki (2016) formulated a refined hyperbolic shear deformation theory for thermal buckling analysis of cross-ply laminated plates with simply supported edge. They derived their equations based on novel refined theory employing a new hyperbolic shear deformation theory. This theory has only four unknown functions involved unlike others that have five. Their theory is variationally consistent and strongly similar to the classical plate theory in many ways. It gives rise to the transverse shear stress variation and does not require the shear correction factor. Thus the transverse shear stresses vary parabolically across the thickness to satisfy free surface conditions for the shear stress. Although, the exact solution is valid and highly accurate, it requires high cost of computing. Atashipour *et al.* (2017) developed the exact Levy-type solution for static bending of symmetric laminated orthotropic plates with different Levy-type boundary conditions. The developed method applied the three dimensional elasticity theory as well as Mindlin-Reissner and Reddy shear deformation plate theories. Their governing equilibrium equations for laminated orthotropic plates and its boundary conditions were obtained by employing the minimum total potential energy principle. The boundary conditions for simply supported, clamped and free edges satisfied their governing equations of both theories. They used two different approaches to solve for the bending analysis of laminated plates with 3-D elastostatic equations for orthotropic materials. First, they obtained the exact closed-form solution using separation of variables method. Second, they obtained the semi-numerical solution for bending of laminated orthotropic plates with Levy-type boundary conditions by employing a combined Fourier differential quadrature approach with the three dimensional elastic theory. However, the solution did not give valid results for symmetric/antisymmetric stress distribution with respect to the mid-plane of a symmetrically laid-up thick laminated plate. That means, the assumed concept of neutral plane is only true for thin to moderately thick laminated plates. If the layup pattern were not appropriately chosen to the suitability of the solution, the stresses at the free edge of isotropic plate as well as stresses at the edge-zones of laminated orthotropic plate will change.

Shimpi and Patel (2006) considered the effect of shear deformation to formulate a two variable refined plate theory for the analysis of orthotropic plates. Their solution uses only two unknown functions as against three in the case of simple shear deformation theories of Mindlin and Reissner. Unlike the first order shear deformation theory it does not required shear correction factor. The polynomial function they used in their formulation is as shown in Equation (2.7):

$$f(z) = \frac{1}{4}\left(\frac{z}{h}\right) - \frac{5}{3}\left(\frac{z}{h}\right)^3 \quad (2.7)$$

This gave rise to transverse shear stress variation such that the transverse shear stresses varied parabolically across the thickness satisfied shear stress free surface conditions. The obtained results for plate with various thickness ratios using the theory were compared with other theories and found that, it is not only substantially more accurate than those obtained using the classical plate theory, but are almost comparable to those obtained using higher order theories having more number of unknown functions. Sarangan and Singh (2017) evaluated the free vibration and bending analysis of laminated composite and sandwich plates by using non-polynomial zigzag models in line with C^0 finite element formulation. They combined zigzag parameters and non-polynomial shear strain functions together with constant variation of transverse displacement. This stand for continuous form of out-plane stresses and parabolic variation across the plate thickness. They also determined improved form of in-plane responses. Their mathematical model consist of lesser number of unknown just like in the case of first order shear deformation theory and it is also layer-wise independent. However, just like first order shear deformation theory, it possesses fewer degree of freedom. Hence, cannot determine shear stresses on "z" plane (τ_{xz} and τ_{yz}). Sayyad *et al.* (2016) studied the bending, buckling and free vibration of cross-ply laminated composite plates based on a simple trigonometric shear deformation theory. They used four unknown variables instead of five as applicable in first order shear deformation theory or any other higher order theories. To capture the effect of shear deformation theory, the in-plane displacement field used sinusoidal function in terms of thickness co-ordinate. Their transverse displacement included bending and shear components. The theory does not require shear correction factor to satisfy the zero shear stress conditions at top and bottom surfaces of plates. Their equation of motion was derived based on the dynamic version of virtual work principle. Also a closed form solution was obtained using double trigonometric series suggested by Navier. The displacements, stresses, critical buckling loads and natural frequencies obtained agreed with previously published research work in this field.

Thai and Choi (2012) employed finite element to formulate equations for static, free vibration and buckling analyses of laminated composite plates. They used higher-order shear deformation plate theory (HSDT) and a combination of node based smoothing discrete shear gap method. The solution used only linear approximations and its implementation into finite element programs was quite simple and efficient. Nali *et al*. (2011) assessed refined theories for buckling analysis of laminated plates subjected to combined bi-axial shear loading. They considered two dimensional plate modelling and applied the principle of virtual displacement. They approximated the solution with the finite element method. They also employed different kinds of plate finite elements. This provided some guidelines and benchmarks useful for identifying the most appropriate modelling for each class of buckling problem. They employed both equivalent Single layer and Layer-wise variable, ensuring the expansion order for thickness variables is generic by applying variable kinematics approach and finite elements method. They obtained their finite element matrices in compact form with reference to Carrera's unified formulation. However, the theory proved inadequate to model thick plates or multilayered plates composed of laminae with high orthotropic ratio.

Ahmed *et al*. (2013) employed the first order shear deformation theory to investigate the behavior of laminated composite plates under transverse loading using an eight-node disoparametric quadratic element. The element has six degrees of freedom at each node: translations in the nodal x, y, and z directions and rotations about the nodal x, y, and z axes . They used static analysis that included the parametric studies on laminated plates to estimate the maximum deflection. Based on the absolute nodal coordinate formulation, Matikainen *et al.* (2009) compared two formulations for a flexible 3-D quadrilateral moderately thick plate element. The two approaches consist of a fully parameterized plate element and a fully parameterized plate element with linearized transverse shear angles to overcome slow convergence and curvature locking. Based on the classical discrete Kirchhoff Triangle, they utilized a thin plate element in large displacement framework for the sake of verification of the formulations and numerical tests. They used the comprehensive set of small deformation static tests and eigen frequency analyses to accomplish the comparison. Their results were limited to known analytical solutions. It was shown that plate elements based on absolute nodal coordinate formulation reach the same result and convergence for pure bending loads. However, under shear deformation loading, slow convergence due to shear locking occurred in the case of an original plate element. Their numerical examples indicated that thickness locking (known also as Poisson locking) was a problem for both of the plate elements based on absolute nodal coordinate formulation.

Raju and Kumar (2011a) employed higher order shear deformation theory with zigzag function to investigate the transient analysis of composite laminated plates. Based on higher order shear deformation theory, they developed an analytical procedure to investigate the transient characteristics of different laminated composite plates. This function ensures slope discontinuities at the interfaces of laminated composite plates. Nguyen, Lee and Cho (2016) presented a triangular finite element using Laplace transform for viscoelastic laminated composite plates. They formulated a three-node multilayered plate element based on the efficient higher-order plate theory. They employed Laplace transform to reduce the integral form of the constitutive equation in the time domain to an algebraic equation in the Laplace domain. The finite element discretization is only used in the spatial domain since the time dimension is transformed to Laplace domain. The modified shape function developed by Specht was applied and converted into Laplace domain in order to pass the proper bending and shear patch tests in arbitrary mesh configurations. Although, their results show good performance but the theory consumes a lot of computational time and resources. Sayyad and Ghugal (2012a) investigated the bending and dynamic response of thick isotropic square and rectangular plates based on the exponential shear deformation theory. Their theory was built upon the classical plate theory. The exponential function in-terms of thickness coordinate in both the in-plane displacements u and v was associated with transverse shear stress distribution through the thickness of plate. They gave their function as shown in Equation (2.8):

$$f(z) = Z\, exp\left[-2\left(\frac{z}{h}\right)^2\right] \tag{2.8}$$

The displacement, refined shear deformation theory and exponential functions are used in terms of thickness co-ordinate to include the effect of transverse shear deformation and rotary inertia. The number of unknown displacement variables in the proposed theory corresponded to that of the first order shear deformation theory. They obtained their transverse shear stress directly from the constitutive relations satisfying the shear stress free surface conditions on the top and bottom surfaces of the plate, hence the theory does not make use of shear correction factor. They also applied dynamic version of the virtual work principle to obtain the governing equations and boundary conditions of the theory. Their study considered simply supported thick isotropic square and rectangular plates. Their results were in good agreement with those of previous scholars.

Goswami and Becker (2013) presented a new displacement based higher order element approach ideally suitable for shear deformable composite and sandwich plates. The element showed rapid convergence, an excellent response against transverse shear loading and does not require shear correction factors with their selected functions for displacements and rotations for each node. It was completely lock-free and behaved extremely well for thin to thick plates. The theory employed higher order displacement terms in the displacement kinematics that made the element rapidly convergent and captured warping effects for composites for each node. The considered element had eleven degrees of freedom per node. They took into account shear strains (γ_{xz} and γ_{yz}) as nodal unknowns and also considered the effect of shear deformation in their formulation. They also developed a Fortran code to implement the element and various examples of isotropic and composite plates. Bouazza *et al.* (2016) used a two-variable simplified nth-higher order shear deformation theory to investigate the free vibration behavior of composite rectangular plates. They used Hamilton's principle to derive their governing equation. They divided their transverse displacement into bending and shear components; thus, the unknown variable is reduced to four as against five or more in other plate theories. This gave rise to transverse shear stresses satisfying free surface conditions. Their solution is variationally consistent, does not require shear correction factors and uses nth-order polynomial term to represent displacement field, but a closed form solution via Navier's technique limits the applicability of the solution technique to simply supported rectangular laminated plates.

Ghugal and Sayyad (2011a, 2011b) used trigonometric shear deformation theory to formulate flexure of cylindrical bending of thick orthotropic plates by taking into account the transverse shear deformation effect as well as transverse normal strain effect. Their displacement field contains three unknowns. The axial displacement field uses sinusoidal function in terms of thickness coordinate to include the shear deformation effect. In order to include the effect of transverse normal strain, the cosine function in thickness coordinates was used in transverse displacement. They applied the principle of virtual work theory to obtain the governing equations and boundary conditions of the theory. Their results for static flexure of simply supported orthotropic plates in cylindrical bending were compared with those of other refined theories and elasticity solution of past scholars. Vaghefi, Baradaran and Koohkan (2010) formulated a version of meshless local Petrov–Galerkin (MLPG) method to obtain three-dimensional (3D) static solutions for thick functionally graded (FG) plates. They assumed the Poisson's ratio to be constant and considered Young's modulus to be graded through the thickness of plates by an exponential function. They used 3D equilibrium equations of elasticity to derive the local symmetric weak formulation. They also used the 3D moving least squares (MLS) to approximate the field variables. Moreover, they considered brick-shaped domains as the local sub-domains and support domains, which made the integrations in the weak form and approximation of the solution variables easier and more accurate. They introduced more nodes in the direction of material variation because of their approach which considered the construction of the shape and the test functions. Consequently, solutions that are more precise were obtained easily and efficiently. They considered several numerical examples containing the stress and deformation analysis of thick functionally graded plates with various boundary conditions under different loading conditions. Their results were in good agreement with the available analytical and numerical solutions of the past scholars.

Rango, Bellomo and Nallim (2015) presented a variational Ritz formulation for vibration analysis of thick quadrilateral laminated plates based on the trigonometric shear deformation theory. Their theory does not require shear correction factor and also ensures shear stresses vanishes at the top and bottom surface of the laminated plate. They applied geometric transformation and mapped out a square domain in the computational space by using a general straight-sided quadrilateral domain as well as four-node master plate. The use of Ritz gives a higher accuracy and faster convergence rate than some other methods like finite element but the solution is very tedious and computationally expensive. Kim *et al.* (2009) employed two variable refined plate theories to investigate the buckling analysis of isotropic and orthotropic plates. The theory does not apply shear correction factor, hence accounts for transverse shear effects and parabolic distribution of the transverse shear strains through the thickness of the plate. Governing equations were derived from the principle of virtual displacements. They used Navier method to obtain the closed-form solution of a simply supported rectangular plate subjected to in-plane loading. Numerical results obtained by the theory were compared with classical plate theory solutions, first-order shear deformable theory solutions, and available exact solution. It was ascertained that the theory was simple and comparable to the first-order shear deformable theory.

Yang and He (2018) developed a new size dependent model which was used for bending, free vibration and buckling analyses of anisotropic layered micro-plates. Their model satisfies the continuity conditions of transverse shear stresses at the interfaces. The discontinuous transverse shear stresses obtained from the constitutive relations were replaced with theirs using the Reissner's mixed variational theorem. This Reissner's mixed variational theorem was employed to obtain the governing equations and corresponding boundary conditions. Comparison with other works on this field shows that the model can accurately predict the mechanical behaviors of the composite laminated plate, but composite laminates are more difficult to delaminate with it when compared with the classical continuum theory. Reddy (2014) formulated a new shear strain shape function which he applied in studying the bending behaviour of exponentially graded material plates (EGMP). His concept was to predict the static bending behavior of graded plates with stretching effect and was based on higher order shear deformation theory. The theory satisfied the zero transverse shear stress conditions on the top and bottom surface of the plates. His modulus of elasticity was assumed to vary exponentially through the thickness direction. Hamilton's principle was adopted when deriving his governing differential equations and boundary conditions. He obtained Navier type closed form solutions for EGMPs subjected to bi-sinusoidal mechanical loads, for simply supported boundary conditions. His obtained results were in good agreement with the results of past scholars, especially when compared with well-known trigonometric shear deformation theory. It was found that the theory was accurate and efficient in predicting the static bending behaviour of exponentially graded material plates.

Sreehari and Maiti (2016) presented buckling and post buckling characteristics of laminated composite plates with damage under thermo-mechanical loading. They applied inverse hyperbolic shear deformation theory in their finite element formulation, which they used to analyze the effect of damage in thin composite plates. Based on the concept of stiffness reduction, they employed anisotropic damage formulation to simulate the damage. The solution is efficient and robust, but the variation in its displacement increases for higher values of a/h, E_1/E_2, and α2/α1. Ghugal and Sayyad (2011b) studied the free vibration of orthotropic thick plates by using trigonometric shear deformation theory. In their work, the in-plane displacement field uses sinusoidal functions in terms of thickness coordinate to include the shear deformation effect. They used the cosine function in terms of thickness coordinate in their transverse displacement to include the effect of transverse normal strain. Their theory was very unique and interesting because the transverse shear stress can be obtained directly from the constitutive relations satisfying the shear stress free surface conditions on the top and bottom surface of the plate. Hence this theory does not require shear correction factor as used in Mindlin theory. Chikalthankar *et al.* (2013) surmised refined plate theory in the analysis of an orthotropic plate. Based on the trigonometric shear deformation theory (TSDT) they statically analyzed a simply supported thick orthotropic flexural plate under uniformly distributed loading. They took into account transverse shear deformation effect. Their theory satisfied stress boundary conditions on the top and bottom of the plate. In this displacement-based trigonometric shear deformation theory, the in-plane displacement field uses sinusoidal function in terms of thickness coordinate to include the shear deformation effect. Their results for static flexural analysis of simply supported thick orthotropic plates for the case of uniformly distributed loading were compared with those of other refined theories and exact solution from theory of elasticity. It was observed that their results were in good agreement with them.

Thai and Kim (2011) used two variable refined plate theory to investigate closed-form solution for buckling analysis of orthotropic plates. They satisfied the zero traction boundary conditions on the top and bottom surfaces of the plate without using shear correction factors and also accounted for a quadratic variation of the transverse shear strains across the thickness. They derived their governing equations from the principle of minimum total potential energy. They employed the state space approach to the Levy-type solution in obtaining the closed-form solutions of rectangular plates with two opposite edges simply supported and the other two edges having arbitrary boundary conditions. The effects of loading condition, boundary condition, and variations of modular ratio, aspect ratio, and thickness ratio on the critical buckling load of orthotropic plates were investigated and obtained results were compared with other theories and found to be in good agreement. Diveyev, Konyk and Crocker (2018) used an exact elasticity solution for simple uniform bending and transverse loading conditions to predict the elastic and damping properties of composite laminated plates. They employed a new stress analysis method for the accurate determination of the detailed stress distribution in laminated plates subjected to cylindrical bending. Their method does not rely on plate models assumptions and it is easily adaptive. The effect of nonlinear variation of displacement, transverse normal strain-stress and transverse deformations of each sheet of the lamina with respect to the thickness coordinate are incorporated in their model. They carried out higher order modeling by employing a model developed for layered beams for both damping caused by the shear strain in the core and damping caused by normal and bending deformation. However, their solution did not consider maximum damping of sandwich structures.

Ghugal and George (2010) examined cylindrical bending of thick isotropic plates using trigonometric shear deformation theory. They considered the effect of transverse shear deformation and their displacement field adopted sinusoidal function in terms of thickness coordinate that has only two variables to include shear deformation effects. Their transverse shear stress was obtained directly from constitutive relations which satisfied the shear stress free boundary conditions at top and bottom surface of the plate. Hence there was no need for shear correction factor. The results obtained were compared with those of classical plate theory, first order shear deformation theory, higher order and other refined plate theories and found to be in good agreement with them. Nguyen-Van, Mai-Duy, Karinasena and Tran-Cong (2011) investigated buckling and free vibration analysis of composite plate/shell structures of various shapes, moduli ratios, span to thickness ratios, boundary conditions and lay-up sequences via a novel smoothed quadrilateral flat element. They incorporated a strain smoothing technique into a flat shell approach in the course of developing the element. Based on the integration along the boundary of smoothing elements, they evaluated the membrane, bending and geometric stiffness matrices, which led to accurate numerical solutions even with badly-shaped elements. Their results were found to be in good agreement with other existing numerical solutions.

Ibearugbulem, Ezeh, Ettu and Gwarah Ledum (2018) analyzed the bending of a rectangular thick plate using polynomial shape function in shear deformation theory. Their work was based on Ritz energy method and only one boundary condition (CCCC) was considered. The transverse shear stress that satisfied zero shear stress condition on the top and bottom surface of the plate and the total potential energy equation of a thick plate were formulated from the principle of elasticity. Their results were in good agreement with those of previous works. Although their solution did not derive its displacement functions, thus; it was assumed and assumed displacement functions will yield assumed values. Enem (2018) used Ritz energy method to analyze nonlinear isotropic rectangular thin plate. The worked is limited to thin plate and considered twelve boundary conditions. The work applied Ritz energy method, Von Karman’s nonlinear governing differential compatibility and equilibrium equation and polynomial shear deformations. Their results were in good agreement with previous work although, their displacement functions were not exact.

It can be stated here that most of the works reviewed so far are not cost efficient, applied assumed displacement functions and also required lengthy computational time.

The previous works that are closely related to the proposed study are summarized in Table 2.1.

Table 2.1: Summary of related works on rectangular thick anisotropic plate.

S/NO	SCHOLAR/YEAR	TOPIC/RESULTS	GAP
1	Nali *et al*. (2011)	**Assessment of refined theories for buckling analysis of laminated plates**. They approximated the solution with the finite element method. They handled the same cases-study with different kinds of plate finite elements. This provided some guidelines and benchmarks useful for identifying the most appropriate modelling for each class of buckling problem. With reference to Carrera's unified formulation, they obtained their finite element matrices in compact form	Authors did not use Polynomial displacement function in energy method. They used finite element method and their theory proved inadequate to model thick plates or multilayered plates composed of laminae with high orthotropic ratio.
2	Matikainen *et al*. (2009)	**Comparison of two moderately thick plate elements based on the absolute nodal coordinate formulation**. Their analysis was based on a classical discrete Kirchhoff triangle in large displacement framework of thin plate element for the sake of verification of the formulations and numerical tests. They used the comprehensive set of small deformation static tests and eigen-frequency analyses to accomplish their comparison.	Researchers did not use polynomial displacement function in energy method. Their results were limited to known analytical solutions.

Table 2.1: continued

3	Yang and He (2018)	**Bending, free vibration and buckling analyses of anisotropic layered micro-plates based on a new size dependent model.** Comparison of the obtained results with other work on this field showed that the model can accurately predict the mechanical behaviors of the composite laminated plate, but composite laminates are more difficult to delaminate with it when compared with the classical continuum theory.	Authors did not use polynomial displacement function in energy method. They used zigzag and re-modified couple stress theory based on higher order deformation plate theory.
4	Badaghi and Saidi (2010)	**Levy-Type solution for buckling analysis of thick functionally graded rectangular plates based on the higher order shear deformation plate theory.** They employed higher order shear deformation theory of plate to derive equilibrium and stability equations. Using Levy-type solution of these equations, they solved for the functionally graded rectangular plate with two opposite edges simply supported under different types of loading conditions. They also carried out detailed studies and discussion of the effects of power of functionally graded material, plate thickness, aspect ratio, loading types and boundary conditions on the critical buckling load of the functionally graded rectangular plate.	Researchers did not use Polynomial displacement function in energy method. They used Levy-type solution based on higher order deformation plate theory.

Table 2.1: continued

5	Bouazza *et al.* (2017)	**A two-variable simplified nth-higher order theory for free vibration behavior of laminated plates.** They used Hamilton's principle to derive their governing equation. Their numerical results were compared with data available in the literature to show the accuracy and simplicity of the proposed theory in analyzing the vibration frequencies of rectangular orthotropic and laminated composite plates. However, a closed form solution via Navier's technique limits the applicability of the solution technique to simply supported rectangular laminated plates.	Authors did not use Polynomial displacement function in energy method. Authors used a two variable nth-higher order shear deformation theory and Hamilton's principle. They considered only one boundary condition (SSSS)
6	Ghugal and Sayyad (2011a)	**Free vibration of thick orthotropic plates using trigonometric shear deformation theory.** They solved the transverse shear stress directly from the constitutive relations which satisfied the shear stress free surface conditions on the top and bottom surface of the plate. Their theory does not require the use of shear correction factor used in Mindlin theory. They also presented a variationally consistent exponential shear deformation theory for the bi-directional bending and free vibration analysis of thick plates.	Researchers did not use polynomial displacement function in energy method. They used trigonometric shear deformation theory.

Table 2.1: continued

7	Sarangan and Singh (2017)	**Evaluation of free vibration and bending analysis of laminated composite and sandwich plates using non-polynomial zigzag models: C^0 finite element formulation.** Their results were in good agreement when compared with previous results of other authors. However, just like first order shear deformation theory, it possesses fewer degree of freedom; hence, limited to a certain degree of freedom for which it can analyze efficiently.	Authors used finite element formulation and their solution is limited to a certain degree of freedom for which it can analyze efficiently.
8	Sayyad and Ghugal (2014)	**Buckling and free vibration analysis of orthotropic plates using exponential shear deformation theory.** The authors obtained the natural frequencies and critical buckling loads of orthotropic plates. Their theory accounts for a parabolic distribution of the transverse shear strain across the thickness and satisfies the zero traction boundary conditions on the top and bottom surfaces of the plate without coordinate correction factors. Navier type solution were also adopted in solving the governing equations of simply supported square orthotropic plates.	Researchers did not use Polynomial displacement function in energy method. They used exponential shear deformation theory and considered only one boundary condition(SSSS)

Table 2.1: continued

9	Atashipour *et al.* (2017)	**Exact levy-type solution for bending of thick laminated orthotropic plates based on 3d elasticity and shear deformation theories.** The solution did not give valid results for symmetric/antisymmetric stress distribution with respect to the mid-plane of a symmetrically laid-up thick laminated plate. That means, the assumed concept of neutral plane is only true for thin to moderately thick laminated plates. Secondly, if the layup pattern were not appropriately chosen to the suitability of the solution, the stresses at the free edge of isotropic plate as well as stresses at the edge-zones of laminated orthotropic plate will change. Their numerical results were in good agreement with the work of previous scholars and can be used as benchmark for investigating the correctness of new solution methods.	Authors did not use Polynomial displacement function in energy method. They used separation of variables method and a combined fourier differential quadrature approach with the three dimensional elastic theory. The solution can accurately solve thin and moderately thick plate but cannot solve thick plate.
10	Hashemi and Arsanjani (2004)	**Exact characteristic equations for some classical boundary conditions of vibrating moderately thick rectangular plates.** The authors studied three dimensional deformed mode shapes together with their associated contour plots obtained from the exact closed form eigen-functions. They also studied the effect of boundary conditions, aspect ratios and thickness ratios on the eigen-frequency.	Researchers did not use Polynomial displacement function in energy method.

Table 2.1: continued

11	Chinosi *et al.* (2017)	**Approximation of anisotropic multilayered plates through Reissner mixed variational theorem (RMVT) and mixed interpolated of tensorial components (MITC) elements.** The developed showed successful performances in approximating the solutions of the structures but does not compute the normal stain ε_{zz} and normal stress σ_{zz} in z directions.	Authors did not use Polynomial displacement function in energy method. They used principal of virtual displacement and Reissner mixed variational theorem.
12	Jam *et al.* (2012)	**Non-linear bending analysis of moderately thick functionally graded plates using generalized differential quadrature method.** They derived the governing system of equations that included a system of thirteen partial differential equations (PDE) in terms of unknown equations based on the first order shear deformation theory and Von Karman type non-linearity, after which they employed the Newton – Raphson iterative scheme to solve the resulting system of non-linear equations to obtain results for both displacement and stress components.	Researchers did not use Polynomial displacement function in energy method. They used generalized differential quadrature method.

Table 2.1: continued

13	Sahoo and Singh (2013)	**A new inverse hyperbolic zigzag theory for the static analysis of laminated composite and sandwich plates.** Their results were in good agreement with the work of previous scholars. However, the thick plates (i.e. for a/h = 2-5) are observed to possess much higher transverse deflections compared to moderately thick to thin plates (i.e. for a/h = 10-100) for each boundary condition. They attributed the deficiency to the effect of transverse flexibility of the core and shear deformation, which are more pronounced in thick plates compared to thin plates.	Authors did not use Polynomial displacement function in energy method. They used inverse hyperbolic zigzag theory. The developed solution does not give accurate results for thick plates.
14	Swaminathan and Sangwai (2009)	**Higher order refined model with 9 degree of freedom for the transverse stress analysis of antisymmetric angle ply laminated composite plates.** They formulated theoretical model that incorporated laminate deformations, which account for the effect of transverse shear deformation. Their equation of equilibrium was determined by applying the principle of minimum potential energy.	Researchers did not use Polynomial displacement function in energy method.

Table 2.1: continued

15	Shinde *et al.* (2015)	**A refined shear deformation theory for bending analysis of isotropic and orthotropic plates under various loading conditions.** Their theory involved two unknown variables which satisfied the shear stress free condition at top and bottom surfaces of the plates without using shear correction factors. They obtained closed form solution by using double trigonometric series that was suggested by Navier. The authors only considered a simply supported isotropic and orthotropic plate subjected to sinusoidally distributed, uniformly distributed and linearly varying loads.	Authors did not use Polynomial displacement function in energy method. They used refined shear deformation theory (trigonometric series). They considered only one boundary condition (SSSS)
16	Touratier (1991)	**An efficient standard plate theory.** The author solved for cosine shear stress distribution and free boundary conditions for shear stress upon the top and bottom surfaces of the plate. His solution does not require shear correction factor. He based his theory on the kinematical approach in which the shear was represented by a certain sinusoidal function. The boundary value problem was deduced from the virtual power principle.	Author's shape function is $f(z) = \frac{h}{\pi}\sin\frac{\pi z}{h}$ and is different from the present proposal. Trigonometric shape function is difficult to handle

Table 2.1: continued

17	Rakocevic *et al.* (2017)	**A computational method for laminated composite plates based on Layerwise theory.** The convergence and numerical stability of the output variables depends on the changes in the side to thickness ratio b/h and modulus ratio E1/E2. Thus, increase in the ratio of b/h introduces numerical instability to the displacement of the solution. This instability starts from b/h > 5 and grows to infinity when b/h = 40 and above. They attributed the cause of the instability to the accumulation of numerical errors and suggested introduction of additional conditions for displacement v on the edge y= 0. Also, in the cases of higher aspect ratio of the plate a/b and cases of small values of the modular ratio e1/e2, the coefficient matrix obtained by applying the equation shown is singular; thus the value of output variables cannot be obtained.	Researchers did not use Polynomial displacement function in energy method. They used Layerwise theory (double trigonometric series).
18	Chikalthankar *et al.* (2013)	**Analysis of orthotropic plate by refined plate theory**. This theory takes account of shear deformation effect and also satisfies stress boundary conditions on the top and bottom of the plate. It considered static flexural analysis of simply supported thick orthotropic plates under uniformly distributed loading.	Authors considered only one boundary condition, (SSSS). They used trigonometric shear deformation theory.

Table 2.1: continued

19	Gunjal *et al.* (2015)	**Buckling analysis of thick plates using refined trigonometric shear deformation theory.** The authors used only two unknowns against three in first order deformation theory and other higher order theories. Their transverse displacement involved bending and shears components. They considered only simply supported isotropic rectangular plate subjected to uniaxial and biaxial compression.	They used refined trigonometric shear deformation theory and considered only one boundary condition (SSSS).
20	Sayyada and Ghugal (2012a)	**Bending and free vibration analysis of thick isotropic plates using exponential shear deformation theory.** The authors used refined shear deformation theory and exponential functions in terms of thickness co-ordinate to account for the effect of transverse shear deformation and rotary inertia. Their theory satisfied the shear stress free surface conditions on the top and bottom surfaces of the plate, hence does not require shear correction factor.	Researchers did not use Polynomial displacement function in energy method. They used exponential shear deformation theory. Authors considered only one boundary condition (SSSS) for both square and rectangular plate.

Table 2.1: continued

21	Reddy (2014)	**Bending behaviour of exponentially graded material plates using new higher order shear deformation theory with stretching effect.** He formulated a new higher order shear deformation theory by assuming modulus of elasticity to vary exponentially through the thickness direction. His theory satisfied the shear stress free condition at top and bottom surface of the plates without applying shear correction factors.	Author did not use Polynomial displacement function in energy method. He used shear strain shape function (new higher order shear deformation theory).
22	Ghugal and George (2010)	**Cylindrical bending of thick isotropic plates using trigonometric shear deformation theory.** They employed constitutive relations to obtain transverse shear stress which satisfied the shear stress free boundary conditions at top and bottom surface of the plate. Thus, their model does not require shear correction factor. They compared their results with those of classical plate theory, first order shear deformation theory, higher order and other refined plate theories to validate the accuracy of their method.	Researchers did not use Polynomial displacement function in energy method. They used trigonometric shear deformation theory.

Table 2.1: continued

23	Bencharif (1992)	**Linear and non-linear deflection analysis of thick rectangular plates using finite differences.** He formulated a model that was more efficient than the former methods used for the computation of linear simultaneous equations for small and large deflection analysis of thick plates. The method was employed to investigate the deflection behaviour of square clamped and simply supported square isotropic thick plates and he later extended it to rectangular thick plates by providing more detailed functions satisfying the rectangular mesh sizes generated automatically by the programme.	Researcher did not use Polynomial displacement function in energy method. He used finite differences method. Only two boundary conditions were considered.
24	Sayyad *et al.* (2016)	**Bending, vibration and buckling of laminated composite plates using a simple four variable plate theory.** They used four unknown variables rather than usual five unknown variables as used in first order theory and many higher order theories. The theory satisfied the zero shear stress conditions at top and bottom surfaces of plates without using shear correction factor. Hence, they determined closed form solution using double trigonometric series suggested by Navier.	Authors did not use Polynomial displacement function in energy method. They used refined trigonometric shear deformation theory.

Table 2.1: continued

25	Sayyad and Ghugal (2012b)	**Buckling analysis of thick isotropic plates using exponential shear deformation theory.** Their theory accounted for a parabolic distribution of the transverse shear strains across the thickness and satisfied the zero traction boundary conditions on the top and bottom surfaces of the plate without applying shear correction factors. They solved for a closed form solutions for buckling analysis of simply supported square plates only.	Researchers did not use Polynomial displacement function in energy method. They used exponential shear deformation theory. Authors considered only one boundary condition (SSSS).
26	Setoodeh and Karami (2004)	**Static free vibration and buckling analysis of anisotropic thick laminated composite plates on distributed and point elastic support using a three-dimensional layer-wise finite element method.** They conveniently and accurately implemented various mixed boundary conditions. They developed models and studied the effects of shear deformation for moderately thick and thick plates with respect to various mixed boundary conditions.	Authors did not use Polynomial displacement function in energy method. They used finite element method.

Table 2.1: continued

27	Thai and Kim (2011)	**Buckling analysis of orthotropic plates based on two variables refined plate theory.** The theory accounts for a quadratic variation of the transverse shear strains across the thickness, and satisfies the zero traction boundary conditions on the top and bottom surfaces of the plate without using shear correction factors. The authors employed Levi-type solution to obtain closed-form solutions of rectangular plates with two opposite edges simply supported and the other two edges having arbitrary boundary conditions. They investigated and obtained results for the effects of boundary condition, loading condition, and variations of modulus ratio, aspect ratio, and thickness ratio on the critical buckling load of orthotropic plates	Researchers did not use Polynomial displacement function in energy method. Only one boundary condition case was considered.
28	Sayyad *et al.* (2013)	**Bending and free vibration analysis of isotropic plates using refined plate theory.** They investigated the realistic variation of the transverse shear stress through the thickness and also satisfied the shear stress free surface conditions at the top and bottom surfaces of the plate. The theory does not require shear correction factor. They solved for only simply supported thick isotropic plate.	Authors did not use Polynomial displacement function in energy method. They used trigonometric shear deformation theory. Only one boundary condition (SSSS) was considered.

Table 2.1: continued

29	Shimpi and Patel (2006)	**A two variable refined plate theory for orthotropic plate analysis.** Their solution have only two unknown functions as against three in the case of simple shear deformation theories of Mindlin and Reissner. Unlike the first order shear deformation theory it does not apply shear correction factor. Their transverse shear stresses varied parabolically across the thickness satisfying shear stress free surface conditions. They obtained results for plate with various thickness ratios. Their shape function is given as: $f(z) = \frac{1}{4}\left(\frac{z}{h}\right) - \frac{5}{3}\left(\frac{z}{h}\right)^2$	Researchers assumed their displacement functions. Their shape function is different from the proposed shape function.
30	Ghugal and Sayyad (2011b)	**Cylindrical bending of thick orthotropic plates using trigonometric shear deformation theory.** Their transverse shear stresses were obtained directly from constitutive relations and satisfied the shear stress free boundary conditions at top and bottom surface of the plate. Thus, their model does not require shear correction factor. They used the principle of virtual work to obtain the governing equations and boundary conditions of the theory. They solved for static flexure of simply supported orthotropic plates in cylindrical bending only.	Authors did not use Polynomial displacement function in energy method. They used trigonometric shear deformation theory. Only one boundary condition was considered (SSSS). Trigonometric function is difficult to handle with respect to integration.

Table 2.1: continued

31	Sadrnejad *et al*. (2009)	**Vibration equations of thick rectangular plates using Mindlin plate theory.** They determined plate mode shapes for different cases. The effect of changes in boundary conditions, size ratio and thickness of vibration behavior of rectangular steel plate were presented. Their results were exact and can be used as a proper criteria to evaluate the error value of approximate methods.	Researchers did not use polynomial displacement function in energy method. Only single boundary condition case was considered (SCSF).
32	Wang *et al.* (2001)	**Elastic/plastic buckling of thick plates of rectangular and circular shapes.** They established that deformation theory gives consistently lower values of buckling stress factor.	Authors did not use Polynomial displacement function in energy method.
33	Kim *et al.* (2009)	**Buckling analysis of plates using two variables refined plate theory.** The theory does not require shear correction factor and at the same time solves for transverse shear effects and parabolic distribution of the transverse shear strains through the thickness of the plate. They obtained a closed-form solution of a simply supported rectangular plate subjected to in-plane loading using the Navier method.	Researchers did not use Polynomial displacement function in energy method. They used refined plate theory. Only single boundary condition case was considered.

Table 2.1: continued

34	Wang and Aung (2007)	**Plastic buckling analysis of thick plates using Ritz method.** They used Mindlin plate theory to solve for transverse shear deformation in thick plate. They also used incremental and deformation theory of plasticity to obtain the plastic buckling behaviour of the plate. Finally, they employed Ritz method to obtain the governing eigenvalue equation for the plastic buckling of uniformly stressed plates with edges defined by polynomial functions.	Authors did not use Polynomial displacement function in energy method. They used Ritz method.
35	Azhari and Kassaei (2004)	**Local buckling analysis of thick anistropic plates using complex finite strip method.** They determine the local buckling behavior by subjecting square and long thick plate to compression bending and shear stresses. They increased the number of strips to obtain more efficient result. They employed the method to investigate the local instability of thick isotropic plates under compression and shear with different boundary conditions.	Researchers did not use Polynomial displacement function in energy method. They used complex finite element method.

From Table 2.1, one can observe that the previous authors did not solve thick plate problem by the proposed polynomial displacement functions in energy method. They assumed their displacement functions and based their analyses mostly on double Fourier series, exponential shear deformation functions, generalized differential quadrature, Finite element approach, etc., However, the assumed displacement functions yielded assumed values, also the methods that have been used by previous authors are very difficult, time consuming and require more funds; hence, the justification of this proposal to address this problem under the title; Analysis of thick anisotropic plate through exact approach using third order shear deformation theory.

CHAPTER THREE

METHODOLOGY

3.1 Formulation of total potential energy functional for a thick anisotropic rectangular plate

The total potential energy functional for a thick anisotropic rectangular plate has been formulated as shown in sections 3.1.1 to 3.1.5.

3.1.1 Assumptions

This work is based on the refined plate theory assumptions as stated below:

i. The displacements, u, v and w are small when compared with plate thickness.

ii. The in-plane displacements, u and v are differentiable in x, y and z axes, while the out-of-plane displacement (deflection), w is only differentiable in x and y axes. This means that the first derivative of w with respect to z is zero. Consequently the vertical strain, $\varepsilon_z = 0$.

iii. The effect of the out-of-plane normal stress on the gross response of the plate is small when compared with other stresses. Thus, it can be neglected. That is, $\sigma_z = 0$.

iv. The vertical line that is initially normal to the middle surface of the plate before bending is no longer straight nor normal to the middle surface after bending. The line is now parabolic. That is, $\phi \neq \theta_c$. where ϕ is the total rotation of the middle surface in this case and θ_c is the classical plate theorem rotation of the middle surface.

Figure 3.1 has been relied upon in formulating the direct governing equation for an anisotropic thick plate under pure bending.

3.1.2 Displacement field

The refined plate theory (RPT) in-plane displacements, u and v are defined mathematically from Figure 3.1 as presented in Equations 3.1 and 3.2.

$$u = u_c + u_s \tag{3.1}$$

$$v = v_c + v_s \tag{3.2}$$

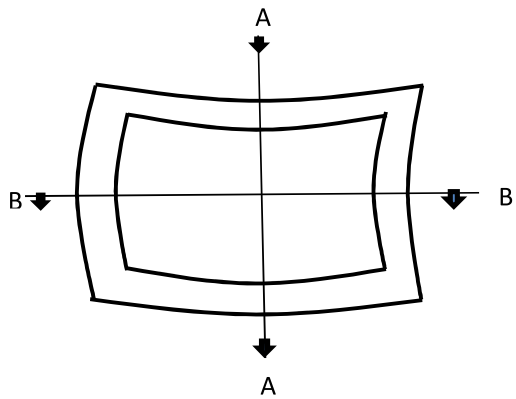
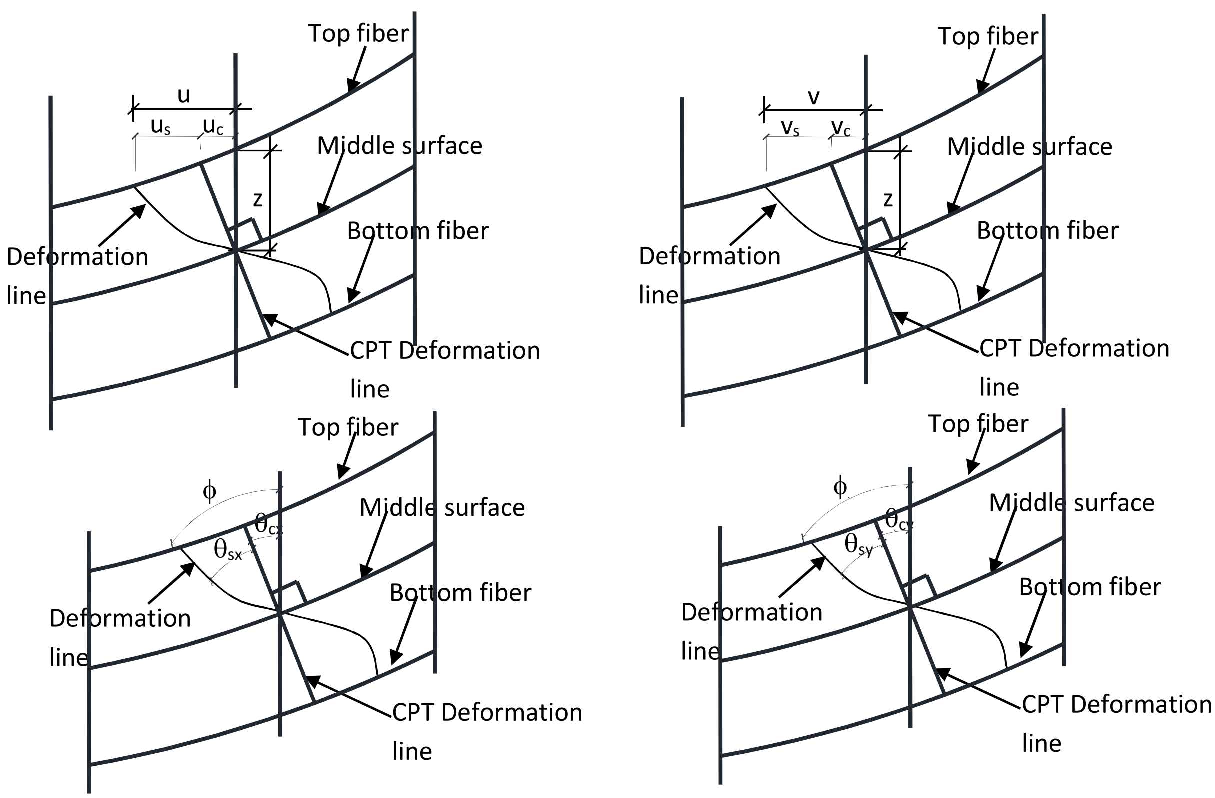


Figure 3.1a: Deformed rectangular plate showing section A-A and B-B



Section A - A　　　　　Section B - B

Figure 3.1b: Deformation of a section of a thick plate

Where:

CPT: Classical Plate Theory

ϕ:	Total rotation of the middle surface
θ_{cx} and θ_{cy}:	Classical plate theorem rotation of the middle surface.
θ_{sx} and θ_{sy}:	Angle between the CPT deformation line and the shear deformation line.
u_c and v_c :	In-plane displacement due to classical plate theory.
u_s and v_s:	In-plane displacement due to shear deformation theory.

Where u and v are the in-plane displacement in x direction y direction respectively, and the out of plane displacement (deflection) is taken as "w".

The classical part of the in-plane displacements u_c and v_c are defined in Equations 3.3 and 3.4.

$$u_c = -z\theta_{cx} = -z\frac{dw}{dx} \qquad 3.3$$

$$v_c = -z\theta_{cy} = -z\frac{dw}{dy} \qquad 3.4$$

Analogously, the shear deformation part of the in-plane displacements u_s and v_s are defined in Equations 3.5 and 3.6.

$$u_s = F(z)\theta_{sx} \qquad 3.5$$

$$v_s = F(z)\theta_{sy} \qquad 3.6$$

Where F(z) is the shear deformation profile is defined in equation 3.7a.

$$F(z) = z - \frac{4}{3}.\frac{z^3}{t^2} = z\left(1 - \frac{4}{3}\left[\frac{z}{t}\right]^2\right) \qquad 3.7a$$

In non-dimensional coordinate (S = z / t) term, the shear deformation profile is defined as shown in Equation 3.7b.

$$F = F(s) = t\left(S - \frac{4}{3}S^3\right) \qquad 3.7b$$

That is:

$$F = tH \qquad 3.7c$$

Where:

$$H = S - \frac{4}{3}S^3 \qquad 3.7d$$

Adding Equations 3.3 and 3.5 gives Equation 3.8a.

$$u = -Z\frac{\partial w}{\partial x} + F(z).\emptyset_x \qquad 3.8a$$

Adding Equations 3.4 and 3.6 gives Equation 3.8b

$$v = -Z\frac{\partial w}{\partial y} + F(z).\emptyset_y \qquad 3.8b$$

In terms of non dimensional coordinates (R = x/a, Q = y/b and S = z/t) and aspect ratio (β = b/a), Equations 3.8a and 3.8b are rewritten as expressed in Equations 3.8c and 3.8d.

$$u = \frac{t}{a}\left[-S\frac{\partial w}{\partial R} + Ha.\emptyset_x\right] \qquad 3.8c$$

$$v = \frac{t}{a\beta}\left[-S\frac{\partial w}{\partial Q} + Ha\beta.\emptyset_y\right] \qquad 3.8d$$

3.1.3 Strain - displacement relations (kinematic relations)

The strain – displacement relations suitable for small deflection of thick anisotropic rectangular plates are considered. From the second assumption in section 3.1.1, the vertical strain ε_z, is equal to zero. Thus, the remaining five engineering strain components are derived by differentiating Equation 3.8a and 3.8d with respect to x and y appropriately. For normal x and y axes strains, it is obtained as expressed in Equation 3.9 and 3.10.

$$\varepsilon_R = \frac{\partial u}{\partial x} = \frac{\partial u}{a\partial R} = \frac{t}{a^2}\left[-S\frac{\partial^2 w}{\partial R^2} + Ha.\frac{\partial \phi_x}{\partial R}\right] \qquad 3.9$$

$$\varepsilon_Q = \frac{\partial v}{\partial y} = \frac{\partial v}{a\beta\partial Q} = \frac{t}{\beta^2 a^2}\left[-S\frac{\partial^2 w}{\partial Q^2} + Ha\beta.\frac{\partial \phi_y}{\partial Q}\right] \qquad 3.10$$

For the two x-y complementary plane shear strains, it is obtained as expressed in Equations 3.11a and 3.11b.

$$\varepsilon_{RQ} = \frac{\partial u}{\partial y} = \frac{\partial u}{a\beta\partial Q} = \frac{t}{\beta a^2}\left[-S\frac{\partial^2 w}{\partial R\partial Q} + Ha.\frac{\partial \phi_x}{\partial Q}\right] \quad 3.11a$$

$$\varepsilon_{QR} = \frac{\partial v}{\partial x} = \frac{\partial v}{a\partial R} = \frac{t}{\beta a^2}\left[-S\frac{\partial^2 w}{\partial R\partial Q} + H\beta a.\frac{\partial \phi_y}{\partial R}\right] \quad 3.11b$$

Adding Equations 3.11a and 3.11b gives the x-y engineering plane shear strain as expressed in Equation 3.11c.

$$\gamma_{RQ} = \left(\varepsilon_{RQ} + \varepsilon_{QR}\right) = \frac{t}{\beta a^2}\left[-2S\frac{\partial^2 w}{\partial R\partial Q} + Ha.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right)\right] \quad 3.11c$$

For the two x-z complementary plane shear strains, it is obtained as expressed in Equations 3.12a and 3.12b.

$$\varepsilon_{RS} = \frac{\partial u}{\partial z} = \frac{\partial u}{t\partial S} = \frac{1}{a}\left[-\frac{\partial w}{\partial R} + a\frac{\partial H}{\partial S}.\emptyset_x\right] \quad 3.12a$$

$$\varepsilon_{SR} = \frac{\partial w}{\partial x} = \frac{1}{a}\frac{\partial w}{\partial R} \quad 3.12b$$

Adding Equations 3.12a and 3.12b gives the x-z engineering plane shear strain as expressed in Equation 3.12c

$$\gamma_{RS} = \varepsilon_{RS} + \varepsilon_{SR}. \ That\ is:$$

$$\gamma_{RS} = \frac{\partial H}{\partial S}.\emptyset_x \quad 3.12c$$

For the two y-z complementary plane shear strains, it is obtained as expressed in Equations 3.13a and 3.13b

$$\varepsilon_{QS} = \frac{\partial v}{\partial z} = \frac{\partial v}{t\partial Sz} = \frac{1}{\beta a}\left[-\frac{\partial w}{\partial Q} + \beta a\frac{\partial H}{\partial S}.\emptyset_y\right] \quad 3.13a$$

$$\varepsilon_{SQ} = \frac{\partial w}{\partial y} = \frac{1}{\beta a}.\frac{\partial w}{\partial Q} \quad 3.13b$$

The y-z engineering shear strain is the summation of the two complementary shear strains of Equations 3.13a and 3.13b.

$$\gamma_{QS} = \varepsilon_{QS} + \varepsilon_{SQ}. \ That\ is:$$

$$\gamma_{QS} = \frac{\partial H}{\partial S} . \emptyset_y \quad 3.13c$$

3.1.4 Constitutive relations (Stress – Strain Relations)

The work applies Hook's and Poisson's theorems to obtain the stress - strain relations. It also makes use of only five stress components (σ_x, σ_y, τ_{xy}, τ_{xz} and τ_{yz}) and corresponding five strain components (τ_{yz}, ε_x,γ_{xy}, γ_{xz}, and γ_{yz}) as shown in Equation 3.14 to 3.18.

$$\varepsilon_1 = \frac{\sigma_1}{E_1} - \mu_{21} \frac{\sigma_2}{E_2} \quad 3.14$$

$$\varepsilon_2 = -\mu_{12} \frac{\sigma_1}{E_1} + \frac{\sigma_2}{E_2} \quad 3.15$$

$$\varepsilon_3 = \frac{1}{G_{12}} . \sigma_3 \quad 3.16$$

$$\varepsilon_4 = \frac{1}{G_{13}} . \sigma_4 \quad 3.17$$

$$\varepsilon_5 = \frac{1}{G_{23}} . \sigma_5 \quad 3.18$$

From the theory of elastic anisotropic plate, transformation engineering strain components from global to local coordinate systems is as expressed in Equation 3.19.

$$\begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \end{bmatrix} = [T] \begin{bmatrix} \varepsilon_x \\ \varepsilon_y \\ \gamma_{xy} \\ \gamma_{xz} \\ \gamma_{yz} \end{bmatrix} \quad 3.19$$

Again, the engineering strain vector and strain tensor vector are related as shown in Equation 3.20.

$$\begin{bmatrix} \varepsilon_x \\ \varepsilon_y \\ \gamma_{xy} \\ \gamma_{xz} \\ \gamma_{yz} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 0 & 2 \end{bmatrix} \begin{bmatrix} \varepsilon_x \\ \varepsilon_y \\ \varepsilon_{xy} \\ \varepsilon_{xz} \\ \varepsilon_{yz} \end{bmatrix} = [\Delta] \begin{bmatrix} \varepsilon_x \\ \varepsilon_y \\ \varepsilon_{xy} \\ \varepsilon_{xz} \\ \varepsilon_{yz} \end{bmatrix} \quad 3.20$$

Rearranging Equation 3.20 gives Equation 3.21.

$$\begin{bmatrix} \varepsilon_x \\ \varepsilon_y \\ \varepsilon_{xy} \\ \varepsilon_{xz} \\ \varepsilon_{yz} \end{bmatrix} = [\Delta]^{-1} \begin{bmatrix} \varepsilon_x \\ \varepsilon_y \\ \gamma_{xy} \\ \gamma_{xz} \\ \gamma_{yz} \end{bmatrix} \qquad 3.21$$

Substituting Equation 3.20 into Equation 3.19 gives Equation 3.22.

$$\begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \end{bmatrix} = [T][\Delta] \begin{bmatrix} \varepsilon_x \\ \varepsilon_y \\ \varepsilon_{xy} \\ \varepsilon_{xz} \\ \varepsilon_{yz} \end{bmatrix} \qquad 3.22$$

Substituting Equation 3.21 into Equation 3.22 gives Equation 3.23.

$$\begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \end{bmatrix} = [T][\Delta][\Delta]^{-1} \begin{bmatrix} \varepsilon_x \\ \varepsilon_y \\ \gamma_{xy} \\ \gamma_{xz} \\ \gamma_{yz} \end{bmatrix} \qquad 3.23$$

In the same way, stress components are transformed from global to local coordinate as shown in Equation 3.24.

$$\begin{bmatrix} \sigma_1 \\ \sigma_2 \\ \sigma_3 \\ \sigma_4 \\ \sigma_5 \end{bmatrix} = \begin{bmatrix} Cos^2\theta & Sin^2\theta & 2Cos\theta\ Sin\theta & 0 & 0 \\ Sin^2\theta & Cos^2\theta & -2Cos\theta\ Sin\theta & 0 & 0 \\ -Cos\theta\ Sin\theta & CoS\theta\ Sin\theta & (Cos^2\theta - Sin^2\theta) & 0 & 0 \\ 0 & 0 & 0 & Cos\theta & Sin\theta \\ 0 & 0 & 0 & -Sin\theta & Cos\theta \end{bmatrix} . \begin{bmatrix} \sigma_x \\ \sigma_y \\ \tau_{xy} \\ \tau_{xz} \\ \tau_{yz} \end{bmatrix} \qquad 3.24$$

From Equation 3.24 we obtain Equation 3.25

$$\begin{bmatrix} \sigma_1 \\ \sigma_2 \\ \sigma_3 \\ \sigma_4 \\ \sigma_5 \end{bmatrix} = \begin{bmatrix} m^2 & n^2 & 2mn & 0 & 0 \\ n^2 & m^2 & -2mn & 0 & 0 \\ -mn & mn & ((m^2 - n^2) & 0 & 0 \\ 0 & 0 & 0 & m & n \\ 0 & 0 & 0 & -n & m \end{bmatrix} . \begin{bmatrix} \sigma_x \\ \sigma_y \\ \tau_{xy} \\ \tau_{xz} \\ \tau_{yz} \end{bmatrix} \qquad 3.25$$

Where m = cos(θ) and n =sin(θ) all angles in radians

Equation 3.25 can be simplified as shown in Equation 3.26

$$\begin{bmatrix}\sigma_1\\\sigma_2\\\sigma_3\\\sigma_4\\\sigma_5\end{bmatrix} = [T]\begin{bmatrix}\sigma_x\\\sigma_y\\\tau_{xy}\\\tau_{xz}\\\tau_{yz}\end{bmatrix} \qquad 3.26$$

Where:

$$[T] = \begin{bmatrix} m^2 & n^2 & 2mn & 0 & 0\\ n^2 & m^2 & -2mn & 0 & 0\\ -mn & mn & ((m^2-n^2) & 0 & 0\\ 0 & 0 & 0 & m & n\\ 0 & 0 & 0 & -n & m\end{bmatrix} \qquad 3.27$$

Rearranging Equation 3.26 gives Equation 3.28

$$\begin{bmatrix}\sigma_x\\\sigma_y\\\tau_{xy}\\\tau_{xz}\\\tau_{yz}\end{bmatrix} = [T]^{-1}\begin{bmatrix}\sigma_1\\\sigma_2\\\sigma_3\\\sigma_4\\\sigma_5\end{bmatrix} \qquad 3.28$$

Equations 3.14, 3.15, 3.16, 3.17 and 3.18 are summarized in matrix form as shown in Equation 3.29

$$\begin{bmatrix}\varepsilon_1\\\varepsilon_2\\\varepsilon_3\\\varepsilon_4\\\varepsilon_5\end{bmatrix} = \begin{bmatrix} 1/E_1 & -\mu_{21}/E_2 & 0 & 0 & 0\\ -\mu_{12}/E_1 & 1/E_2 & 0 & 0 & 0\\ 0 & 0 & 1/G_{12} & 0 & 0\\ 0 & 0 & 0 & 1/G_{13} & 0\\ 0 & 0 & 0 & 0 & 1/G_{23}\end{bmatrix} . \begin{bmatrix}\sigma_1\\\sigma_2\\\sigma_3\\\sigma_4\\\sigma_5\end{bmatrix} \qquad 3.29$$

Equation 3.29 can be simplified as shown in Equation 3.30

$$\begin{bmatrix}\varepsilon_1\\\varepsilon_2\\\varepsilon_3\\\varepsilon_4\\\varepsilon_5\end{bmatrix} = [E]^{-1}. \begin{bmatrix}\sigma_1\\\sigma_2\\\sigma_3\\\sigma_4\\\sigma_5\end{bmatrix} \qquad 3.30$$

Solving Equation 3.29 gives Equation 3.31

$$\begin{bmatrix}\sigma_1\\\sigma_2\\\sigma_3\\\sigma_4\\\sigma_5\end{bmatrix} = \frac{1}{1-\mu_{12}\mu_{21}}\begin{bmatrix} E_1 & E_2 \,.\, \mu_{12} & 0 & 0 & 0\\ E_1 \,.\, \mu_{21} & E_2 & 0 & 0 & 0\\ 0 & 0 & {G_{12}}^* & 0 & 0\\ 0 & 0 & 0 & {G_{13}}^* & 0\\ 0 & 0 & 0 & 0 & {G_{23}}^*\end{bmatrix} . \begin{bmatrix}\varepsilon_1\\\varepsilon_2\\\varepsilon_3\\\varepsilon_4\\\varepsilon_5\end{bmatrix} \qquad 3.31$$

Equation 3.31 can be simplified as shown in Equation 3.32

$$\begin{bmatrix} \sigma_1 \\ \sigma_2 \\ \sigma_3 \\ \sigma_4 \\ \sigma_5 \end{bmatrix} = [E].\begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \end{bmatrix} \quad 3.32$$

Where:

$$G_{12}{}^{*} = G_{12}(1 - \mu_{12}\mu_{21}) \quad 3.33$$

$$G_{13}{}^{*} = G_{13}(1 - \mu_{12}\mu_{21}) \quad 3.34$$

$$G_{23}{}^{*} = G_{23}(1 - \mu_{12}\mu_{21}) \quad 3.35$$

Substituting Equation 3.32 into Equation 3.28 gives Equation 3.36

$$\begin{bmatrix} \sigma_x \\ \sigma_y \\ \tau_{xy} \\ \tau_{xz} \\ \tau_{yz} \end{bmatrix} = [T]^{-1}\,[E].\begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \end{bmatrix} \quad 3.36$$

Substituting Equation 3.23 into equation 3.36 gives Equation 3.37

$$\begin{bmatrix} \sigma_x \\ \sigma_y \\ \tau_{xy} \\ \tau_{xz} \\ \tau_{yz} \end{bmatrix} = [T]^{-1}\,[E].[\Delta][T][\Delta]^{-1}\begin{bmatrix} \varepsilon_x \\ \varepsilon_y \\ \gamma_{xy} \\ \gamma_{xz} \\ \gamma_{yz} \end{bmatrix} \quad 3.37$$

But from transformation engineering strain we have Equation 3.38:

$$[\Delta].[T].[\Delta]^{-1} = [T]^{-T} \quad 3.38$$

Substituting Equation 3.28 into Equation 3.37 gives Equation 3.39

$$\begin{bmatrix} \sigma_x \\ \sigma_y \\ \tau_{xy} \\ \tau_{xz} \\ \tau_{yz} \end{bmatrix} = [T]^{-1}\,[E].[T]^{-T}\begin{bmatrix} \varepsilon_x \\ \varepsilon_y \\ \gamma_{xy} \\ \gamma_{xz} \\ \gamma_{yz} \end{bmatrix} \quad 3.39$$

Equation 3.39 can be simplified as shown in Equation 3.40

$$\begin{bmatrix} \sigma_x \\ \sigma_y \\ \tau_{xy} \\ \tau_{xz} \\ \tau_{yz} \end{bmatrix} = [EE] \begin{bmatrix} \varepsilon_x \\ \varepsilon_y \\ \gamma_{xy} \\ \gamma_{xz} \\ \gamma_{yz} \end{bmatrix} \quad 3.40$$

Where:

$$[EE] = [T]^{-1}\,[E].\,[T]^{-T} \quad 3.41$$

$$[E] = \frac{1}{1-\mu_{12}\mu_{21}} \begin{bmatrix} E_1 & E_2\,.\,\mu_{12} & 0 & 0 & 0 \\ E_1\,.\,\mu_{21} & E_2 & 0 & 0 & 0 \\ 0 & 0 & {G_{12}}^* & 0 & 0 \\ 0 & 0 & 0 & {G_{13}}^* & 0 \\ 0 & 0 & 0 & 0 & {G_{23}}^* \end{bmatrix} \quad 3.42a$$

Equation 3.42a can be simplified to obtain Equation 3.42b

$$[E] = \frac{1}{1-\mu_{12}\mu_{21}} \begin{bmatrix} E_{11} & E_{12} & 0 & 0 & 0 \\ E_{21} & E_{22} & 0 & 0 & 0 \\ 0 & 0 & E_{33} & 0 & 0 \\ 0 & 0 & 0 & E_{44} & 0 \\ 0 & 0 & 0 & 0 & E_{55} \end{bmatrix} \quad 3.42b$$

Equation 3.42b is rewritten as expressed in Equation 3,42c

$$[E] = \frac{E_0}{1-\mu_{12}\mu_{21}} \begin{bmatrix} d_{11} & d_{12} & 0 & 0 & 0 \\ d_{21} & d_{22} & 0 & 0 & 0 \\ 0 & 0 & d_{33} & 0 & 0 \\ 0 & 0 & 0 & d_{44} & 0 \\ 0 & 0 & 0 & 0 & d_{55} \end{bmatrix} \quad 3.42c$$

The values of elastic moduli (E) can be substituted as shown in Equation 3.43 to Equation 3.49

$$E_{11} = E_1 \;\; and \; d_{11} = E_{11}/E_0 \quad 3.43$$

$$E_{12} = E_2\,.\,\mu_{12} \;\; and \; d_{12} = E_{12}/E_0 \quad 3.44$$

$$E_{21} = E_1\,.\,\mu_{21} \; and \; d_{21} = E_{21}/E_0 \quad 3.45$$

$$E_{22} = E_2 \;\; and \; d_{22} = E_{22}/E_0 \quad 3.46$$

$$E_{33} = G_{12}(1-\mu_{12}\mu_{21}) \quad and \; d_{33} = E_{33}/E_0 \quad 3.47$$

$$E_{44} = G_{13}(1-\mu_{12}\mu_{21}) \quad and \; d_{44} = E_{44}/E_0 \quad 3.48$$

$$E_{55} = G_{23}(1 - \mu_{12}\mu_{21}) \ and \ d_{55} = E_{55}/E_0 \quad 3.49$$

Substituting Equations 3.27 and 3.42 into Equation 3.41 gives Equation 3.50

$$[EE] = \frac{E_0}{1 - \mu_{12}\mu_{21}} \begin{bmatrix} B_{11} & B_{12} & B_{13} & 0 & 0 \\ B_{21} & B_{22} & B_{23} & 0 & 0 \\ B_{31} & B_{32} & B_{33} & 0 & 0 \\ 0 & 0 & 0 & B_{44} & 0 \\ 0 & 0 & 0 & 0 & B_{55} \end{bmatrix} \quad 3.50$$

Where the following values of 'B' can be defined from anisotropic principle as shown in Equation 3.51 to Equation 3.59:

$$B_{11} = m^4 d_{11} + 2m^2 n^2 (d_{12} + 2d_{33}) + n^4 d_{22} \quad 3.51$$

$$B_{12} = d_{12}(n^4 + m^4) + m^2 n^2 (d_{11} + d_{22} - 4d_{33}) \quad 3.52$$

$$B_{13} = m^3 n (d_{11} - d_{12} - 2d_{33}) + mn^3 (d_{12} - d_{22} + 2d_{33}) \quad 3.53$$

$$B_{22} = n^4 d_{11} + 2m^2 n^2 (d_{12} + 2d_{33}) + m^4 d_{22} \quad 3.54$$

$$B_{23} = mn^3 d_{11} - m^3 n d_{22} + (m^3 n - mn^3)(d_{12} + 2d_{33}) \quad 3.56$$

$$B_{33} = m^2 n^2 (d_{11} - 2d_{12} + d_{22} - 2d_{33}) + d_{33}(m^4 + n^4) \quad 3.57$$

$$B_{21} = B_{12}, \qquad B_{31} = B_{13} \ and \ \ B_{32} = B_{23}$$

$$B_{44} = d_{44} \quad 3.58$$

$$B_{55} = d_{55} \quad 3.59$$

Substituting Equation 3.50 into Equation 3.40 gives the expressions of Equations 3.60 to Equation 3.64.

$$\sigma_x = \frac{E_0}{1 - \mu_{12}\mu_{21}} \left(B_{11} . \varepsilon_x + B_{12} . \varepsilon_y + B_{13} . \gamma_{xy}\right) \quad 3.60$$

$$\sigma_y = \frac{E_0}{1 - \mu_{12}\mu_{21}} \left(B_{21} . \varepsilon_x + B_{22} . \varepsilon_y + B_{23} . \gamma_{xy}\right) \quad 3.61$$

$$\tau_{xy} = \frac{E_0}{1 - \mu_{12}\mu_{21}} \left(B_{31} . \varepsilon_x + B_{32} . \varepsilon_y + B_{33} . \gamma_{xy}\right) \quad 3.62$$

$$\tau_{xz} = \frac{E_0}{1 - \mu_{12}\mu_{21}} B_{44} . \gamma_{xz} \quad 3.63$$

$$\tau_{yz} = \frac{E_0}{1-\mu_{12}\mu_{21}} B_{55}.\gamma_{yz} \qquad 3.64$$

Substituting Equations 3.9, 3.10 and 3.11c into Equation 3.60 gives Equation 3.65

$$\sigma_R = \frac{E_0 t}{[1-\mu_{xy}\mu_{yx}]a^2}.\left(B_{11}.\left[-S\frac{\partial^2 w}{\partial R^2} + Ha.\frac{\partial \phi_x}{\partial R}\right] + \frac{B_{12}}{\beta^2}.\left[-S\frac{\partial^2 w}{\partial Q^2} + Ha\beta.\frac{\partial \phi_y}{\partial Q}\right]\right.$$
$$\left. + \frac{B_{13}}{\beta}.\left[-2S\frac{\partial^2 w}{\partial R \partial Q} + Ha.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right)\right]\right) \qquad 3.65$$

Substituting Equations 3.9 and 3.10 into Equation 3.25 gives Equation 3.66

$$\sigma_Q = \frac{E_0 t}{[1-\mu_{xy}\mu_{yx}]a^2}.\left(B_{21}.\left[-S\frac{\partial^2 w}{\partial R^2} + Ha.\frac{\partial \phi_x}{\partial R}\right] + \frac{B_{22}}{\beta^2}.\left[-S\frac{\partial^2 w}{\partial Q^2} + Ha\beta.\frac{\partial \phi_y}{\partial Q}\right]\right.$$
$$\left. + \frac{B_{23}}{\beta}.\left[-2S\frac{\partial^2 w}{\partial R \partial Q} + Ha.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right)\right]\right) \qquad 3.66$$

Substituting Equation 3.11c into Equation 3.26 gives Equation 3.67

$$\tau_{RQ} = \frac{E_0 t}{[1-\mu_{xy}\mu_{yx}]a^2}.\left(B_{31}.\left[-S\frac{\partial^2 w}{\partial R^2} + Ha.\frac{\partial \phi_x}{\partial R}\right] + \frac{B_{32}}{\beta^2}.\left[-S\frac{\partial^2 w}{\partial Q^2} + Ha\beta.\frac{\partial \phi_y}{\partial Q}\right]\right.$$
$$\left. + \frac{B_{33}}{\beta}.\left[-2S\frac{\partial^2 w}{\partial R \partial Q} + Ha.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right)\right]\right) \qquad 3.67$$

Substituting Equation 3.12c into Equation 3.27 gives Equation 3.68

$$\tau_{RS} = \frac{E_0}{1-\mu_{xy}\mu_{yx}}.B_{44}.\left[\frac{\partial H}{\partial S}\right].\emptyset_x = \frac{E_0 t}{[1-\mu_{xy}\mu_{yx}]a^2}.B_{44}.\left[\frac{a^2}{t}.\frac{\partial H}{\partial S}\right].\emptyset_x \qquad 3.68$$

Substituting Equation 3.13c into Equation 3.28 gives Equation 3.69

$$\tau_{QS} = \frac{E_0}{1-\mu_{xy}\mu_{yx}}.B_{55}.\left[\frac{\partial H}{\partial S}\right].\emptyset_y = \frac{E_0 t}{[1-\mu_{xy}\mu_{yx}]a^2}.B_{55}.\left[\frac{a^2}{t}.\frac{\partial H}{\partial S}\right].\emptyset_y \qquad 3.69$$

3.1.5 Total potential energy functional

The average strain energy of the thick plate is the indefinite summations of the average dot products of the strain and their corresponding stress components in the domains of x, y and z. That is: the general expression for the strain energy is as expressed in Equation 3.70a.

$$U = \frac{1}{2}\int_{0}^{a}\int_{0}^{b}\int_{-0.5t}^{0.5t} \left(\sigma_x\varepsilon_x + \sigma_y\varepsilon_y + \tau_{xy}\gamma_{xy} + \tau_{xz}\gamma_{xz} + \tau_{yz}\gamma_{yz}\right) dx\, dy\, dz \qquad 3.70a$$

In terms of the non dimensional coordinates, R, Q, and S, Equation 3.70a is written as Equation 3.70b

$$U = \frac{abt}{2}\int_{0}^{1}\int_{0}^{1}\int_{-0.5}^{0.5} \left(\sigma_R\varepsilon_R + \sigma_Q\varepsilon_Q + \tau_{RQ}\gamma_{RQ} + \tau_{RS}\gamma_{RS} + \tau_{QS}\gamma_{QS}\right) dR\, dQ\, dS \qquad 3.70b$$

The products of engineering strains and their corresponding stresses were multiplied together. That is, Equation 3.9 multiply by Equation 3.65 to give Equation 3.71

$$\sigma_R\,\varepsilon_R = \frac{E_0 t^2}{[1-\mu_{xy}\mu_{yx}]a^4}.\Bigg(B_{11}.\left[S^2\left(\frac{\partial^2 w}{\partial R^2}\right)^2 - 2SHa.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} + H^2a^2.\left(\frac{\partial \phi_x}{\partial R}\right)^2\right]$$
$$+\frac{B_{12}}{\beta^2}.\left[S^2\left(\frac{\partial^2 w}{\partial R\,\partial Q}\right)^2 - \frac{SHa}{\beta}\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} - SHa\beta^2\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} + H^2a^2\beta.\frac{\partial \phi_y}{\partial Q}.\frac{\partial \phi_x}{\partial R}\right]$$
$$+\frac{B_{13}}{\beta}.\left[2S^2\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial R^2} - SHa.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial R^2} - 2S.Ha\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial R}\right.$$
$$\left. + H^2a^2.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_x}{\partial R}\right]\Bigg) \qquad 3.71$$

Multiply Equation 3.10 by Equation 3.66 gives the expression of Equation 3.72

$$\sigma_Q\,\varepsilon_Q = \frac{E_0 t^2}{[1-\mu_{xy}\mu_{yx}]a^4}.\Bigg(\frac{B_{22}}{\beta^4}.\left[S^2\left(\frac{\partial^2 w}{\partial Q^2}\right)^2 - 2SHa\beta.\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} + H^2a^2\beta^2.\left(\frac{\partial \phi_y}{\partial Q}\right)^2\right]$$
$$+\frac{B_{21}}{\beta^2}.\left[S^2\left(\frac{\partial^2 w}{\partial R\,\partial Q}\right)^2 - SHa.\frac{\partial \phi_x}{\partial R}.\frac{\partial^2 w}{\partial Q^2} - SHa\beta.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_y}{\partial Q} + H^2a^2\beta.\frac{\partial \phi_x}{\partial R}.\frac{\partial \phi_y}{\partial Q}\right]$$
$$+\frac{B_{23}}{\beta^3}.\left[2S^2\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial Q^2} - SH\;.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial Q^2} - 2SH\;.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial Q}\right.$$
$$\left. + H^2a^2\beta.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_y}{\partial Q}\right]\Bigg) \qquad 3.72$$

Multipling Equation 3.11c by Equation 3.67 gives the expression of Equation 3.73

$$\tau_{RQ}\gamma_{RQ} = \frac{\mathrm{E_0 t^2}}{[1-\mu_{xy}\mu_{yx}]a^4}.\left[\frac{\mathrm{B_{31}}}{\beta}.\left[2S^2.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial R^2} - SHa.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right)\frac{\partial^2 w}{\partial R^2}\right.\right.$$

$$\left. - 2SHa.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial R} + H^2a^2.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_x}{\partial R}\right]$$

$$+ \frac{\mathrm{B_{32}}}{\beta^3}.\left[2S^2.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial Q^2} - SHa.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial Q^2} - 2SHa\beta.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial Q}\right.$$

$$\left. + H^2a^2\beta.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_y}{\partial Q}\right]$$

$$+ \frac{\mathrm{B_{33}}}{\beta^2}.\left[4S^2\left(\frac{\partial^2 w}{\partial R\partial Q}\right)^2 - 2SHa.\left(\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial Q} + \beta\,\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial R}\right)\right.$$

$$\left.\left. + H^2a^2.\left(\left(\frac{\partial \phi_x}{\partial Q}\right)^2 + 2\beta\,\frac{\partial \phi_x}{\partial Q}.\frac{\partial \phi_y}{\partial R} + \beta^2.\left(\frac{\partial \phi_y}{\partial R}\right)^2\right)\right]\right] \qquad 3.73$$

Multiply Equation 3.12c by Equation 3.38 gives the expression of Equation 3.74a

$$\tau_{RS}\gamma_{RS} = \frac{\mathrm{E_0 t}}{[1-\mu_{xy}\mu_{yx}]a^2}.\mathrm{B_{44}}.\frac{a^2}{\mathrm{t}}.\left[\frac{\partial H}{\partial S}\right]^2.\emptyset_x{}^2 \qquad 3.74a$$

Equation 3.74a can be rearranged to obtain the expression of Equation 3.74b

$$\tau_{RS}\gamma_{RS} = \frac{\mathrm{E_0 t^2}}{[1-\mu_{xy}\mu_{yx}]a^4}.a^2\mathrm{B_{44}}.\left(\frac{a}{t}\right)^2.\left[\frac{\partial H}{\partial S}\right]^2.\emptyset_x{}^2 \qquad 3.74b$$

Multipling Equation 3.13c by Equation 3.69 gives the expression of Equation 3.75a

$$\tau_{QS}\gamma_{QS} = \frac{\mathrm{E_0 t}}{[1-\mu_{xy}\mu_{yx}]a^2}.\mathrm{B_{55}}.\frac{a^2}{\mathrm{t}}.\left[\frac{\partial H}{\partial S}\right]^2.\emptyset_y{}^2 \qquad 3.75a$$

Rearranging Equation 3.75a give the expression of Equation 3.75b

$$\tau_{QS}\gamma_{QS} = \frac{\mathrm{E_0 t^2}}{[1-\mu_{xy}\mu_{yx}]a^4}.a^2\mathrm{B_{55}}.\left(\frac{a}{t}\right)^2.\left[\frac{\partial H}{\partial S}\right]^2.\emptyset_y{}^2 \qquad 3.75b$$

Summing Equations 3.71, 3.72, 3.73, 3.74 and 3.75 gives the expression of Equation 3.76a

$$\sigma.\varepsilon = \frac{\mathrm{E_0 t^2}}{[1-\mu_{xy}\mu_{yx}]a^4}\Bigg\{\mathrm{B}_{11}.\left[S^2\left(\frac{\partial^2 w}{\partial R^2}\right)^2 - 2SHa.\frac{\partial^2 w}{\partial R^2}.\frac{\partial\phi_x}{\partial R} + H^2a^2.\left(\frac{\partial\phi_x}{\partial R}\right)^2\right]$$

$$+\frac{\mathrm{B}_{12}}{\beta^2}.\left[S^2\left(\frac{\partial^2 w}{\partial R\,\partial Q}\right)^2 - \frac{SHa}{\beta}\frac{\partial^2 w}{\partial Q^2}.\frac{\partial\phi_y}{\partial Q} - SHa\beta^2\frac{\partial^2 w}{\partial R^2}.\frac{\partial\phi_x}{\partial R} + H^2a^2\beta.\frac{\partial\phi_y}{\partial Q}.\frac{\partial\phi_x}{\partial R}\right]$$

$$+\frac{B_{13}}{\beta}.\left[2S^2\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial R^2} - SHa.\left(\frac{\partial\phi_x}{\partial Q}+\beta.\frac{\partial\phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial R^2} - 2S.Ha\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial\phi_x}{\partial R}\right.$$

$$\left.+H^2a^2.\left(\frac{\partial\phi_x}{\partial Q}+\beta.\frac{\partial\phi_y}{\partial R}\right).\frac{\partial\phi_x}{\partial R}\right]$$

$$+\frac{\mathrm{B}_{22}}{\beta^4}.\left[S^2\left(\frac{\partial^2 w}{\partial Q^2}\right)^2 - 2SHa\beta.\frac{\partial^2 w}{\partial Q^2}.\frac{\partial\phi_y}{\partial Q} + H^2a^2\beta^2.\left(\frac{\partial\phi_y}{\partial Q}\right)^2\right]$$

$$+\frac{\mathrm{B}_{21}}{\beta^2}.\left[S^2\left(\frac{\partial^2 w}{\partial R\,\partial Q}\right)^2 - SHa.\frac{\partial\phi_x}{\partial R}.\frac{\partial^2 w}{\partial Q^2} - SHa\beta.\frac{\partial^2 w}{\partial R^2}.\frac{\partial\phi_y}{\partial Q} + H^2a^2\beta.\frac{\partial\phi_x}{\partial R}.\frac{\partial\phi_y}{\partial Q}\right]$$

$$+\frac{B_{23}}{\beta^3}.\left[2S^2\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial Q^2} - SHa.\left(\frac{\partial\phi_x}{\partial Q}+\beta.\frac{\partial\phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial Q^2} - 2SHa\beta.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial\phi_y}{\partial Q}\right.$$

$$\left.+H^2a^2\beta.\left(\frac{\partial\phi_x}{\partial Q}+\beta.\frac{\partial\phi_y}{\partial R}\right).\frac{\partial\phi_y}{\partial Q}\right]$$

$$+\frac{\mathrm{B}_{31}}{\beta}.\left[2S^2.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial R^2} - SHa.\left(\frac{\partial\phi_x}{\partial Q}+\beta.\frac{\partial\phi_y}{\partial R}\right)\frac{\partial^2 w}{\partial R^2} - 2SHa.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial\phi_x}{\partial R}\right.$$

$$\left.+H^2a^2.\left(\frac{\partial\phi_x}{\partial Q}+\beta.\frac{\partial\phi_y}{\partial R}\right).\frac{\partial\phi_x}{\partial R}\right]$$

$$+\frac{\mathrm{B}_{32}}{\beta^3}.\left[2S^2.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial Q^2} - SHa.\left(\frac{\partial\phi_x}{\partial Q}+\beta.\frac{\partial\phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial Q^2} - 2SHa\beta.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial\phi_y}{\partial Q}\right.$$

$$\left.+H^2a^2\beta.\left(\frac{\partial\phi_x}{\partial Q}+\beta.\frac{\partial\phi_y}{\partial R}\right).\frac{\partial\phi_y}{\partial Q}\right]$$

$$+\frac{\mathrm{B}_{33}}{\beta^2}.\left[4S^2\left(\frac{\partial^2 w}{\partial R\partial Q}\right)^2 - 2SHa.\left(\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial\phi_x}{\partial Q} + \beta\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial\phi_y}{\partial R}\right)\right.$$

$$\left.+H^2a^2.\left(\left(\frac{\partial\phi_x}{\partial Q}\right)^2 + 2\beta\frac{\partial\phi_x}{\partial Q}.\frac{\partial\phi_y}{\partial R} + \beta^2.\left(\frac{\partial\phi_y}{\partial R}\right)^2\right)\right] + +a^2\mathrm{B}_{44}.\left(\frac{a}{t}\right)^2.\left[\frac{\partial H}{\partial S}\right]^2.\emptyset_x{}^2$$

$$+a^2\mathrm{B}_{55}.\left(\frac{a}{t}\right)^2.\left[\frac{\partial H}{\partial S}\right]^2.\emptyset_y{}^2\Bigg\} \qquad 3.76a$$

Collecting like terms in Equation 3.76a gives Equation 3.76b

$$\sigma.\varepsilon = \frac{E_0 t^2}{[1-\mu_{xy}\mu_{yx}]a^4}\Bigg\{B_{11}.\left[S^2\left(\frac{\partial^2 w}{\partial R^2}\right)^2 - 2SHa.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} + H^2a^2.\left(\frac{\partial \phi_x}{\partial R}\right)^2\right]$$

$$+\frac{B_{12}}{\beta^2}.\left[S^2\left(\frac{\partial^2 w}{\partial R\,\partial Q}\right)^2 - \frac{SHa}{\beta}\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} - SHa\beta^2\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} + H^2a^2\beta.\frac{\partial \phi_y}{\partial Q}.\frac{\partial \phi_x}{\partial R}\right]$$

$$+\frac{B_{21}}{\beta^2}.\left[S^2\left(\frac{\partial^2 w}{\partial R\,\partial Q}\right)^2 - SHa.\frac{\partial \phi_x}{\partial R}.\frac{\partial^2 w}{\partial Q^2} - SHa\beta.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_y}{\partial Q} + H^2a^2\beta.\frac{\partial \phi_x}{\partial R}.\frac{\partial \phi_y}{\partial Q}\right]$$

$$+\frac{B_{13}}{\beta}.\left[2S^2\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial R^2} - SHa.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial R^2} - 2S.Ha\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial R}\right.$$

$$\left. + H^2a^2.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_x}{\partial R}\right]$$

$$+\frac{B_{31}}{\beta}.\left[2S^2.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial R^2} - SHa.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right)\frac{\partial^2 w}{\partial R^2} - 2SHa.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial R}\right.$$

$$\left. + H^2a^2.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_x}{\partial R}\right]$$

$$+\frac{B_{22}}{\beta^4}.\left[S^2\left(\frac{\partial^2 w}{\partial Q^2}\right)^2 - 2SHa\beta.\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} + H^2a^2\beta^2.\left(\frac{\partial \phi_y}{\partial Q}\right)^2\right]$$

$$+\frac{B_{23}}{\beta^3}.\left[2S^2\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial Q^2} - SHa.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial Q^2} - 2SHa\beta.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial Q}\right.$$

$$\left. + H^2a^2\beta.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_y}{\partial Q}\right]$$

$$+\frac{B_{32}}{\beta^3}.\left[2S^2.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial Q^2} - SHa.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial Q^2} - 2SHa\beta.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial Q}\right.$$

$$\left. + H^2a^2\beta.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_y}{\partial Q}\right]$$

$$+\frac{B_{33}}{\beta^2}.\left[4S^2\left(\frac{\partial^2 w}{\partial R\partial Q}\right)^2 - 2SHa.\left(\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial Q} + \beta\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial R}\right)\right.$$

$$\left. + H^2a^2.\left(\left(\frac{\partial \phi_x}{\partial Q}\right)^2 + 2\beta\frac{\partial \phi_x}{\partial Q}.\frac{\partial \phi_y}{\partial R} + \beta^2.\left(\frac{\partial \phi_y}{\partial R}\right)^2\right)\right] + +a^2 B_{44}.\left(\frac{a}{t}\right)^2.\left[\frac{\partial H}{\partial S}\right]^2.\emptyset_x{}^2$$

$$+ a^2 B_{55}.\left(\frac{a}{t}\right)^2.\left[\frac{\partial H}{\partial S}\right]^2.\emptyset_y{}^2\Bigg\} \qquad 3.76b$$

Simplifying Equation 3.76b gives the expression of Equation 3.76c

Note; $B_{12} = B_{21}$, $B_{31} = B_{13}$, $B_{23} = B_{32}$

$$\sigma.\varepsilon = \frac{E_0 t^2}{[1-\mu_{xy}\mu_{yx}]a^4}\Bigg\{B_{11}.\left[S^2\left(\frac{\partial^2 w}{\partial R^2}\right)^2 - 2SHa.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} + H^2 a^2.\left(\frac{\partial \phi_x}{\partial R}\right)^2\right]$$

$$+\frac{B_{12}}{\beta^2}.\left[2S^2\left(\frac{\partial^2 w}{\partial R\,\partial Q}\right)^2 - \frac{SHa}{\beta}\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} - SHa\beta^2\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} - SHa.\frac{\partial \phi_x}{\partial R}.\frac{\partial^2 w}{\partial Q^2}\right.$$

$$\left. - SHa\beta.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_y}{\partial Q} + 2H^2 a^2 \beta.\frac{\partial \phi_x}{\partial R}.\frac{\partial \phi_y}{\partial Q}\right]$$

$$+\frac{B_{13}}{\beta}.\left[4S^2\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial R^2} - 2SHa.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial R^2} - 4S.Ha\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial R}\right.$$

$$\left. + 2H^2 a^2.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_x}{\partial R}\right]$$

$$+\frac{B_{22}}{\beta^4}.\left[S^2\left(\frac{\partial^2 w}{\partial Q^2}\right)^2 - 2SHa\beta.\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} + H^2 a^2 \beta^2.\left(\frac{\partial \phi_y}{\partial Q}\right)^2\right]$$

$$+\frac{B_{23}}{\beta^3}.\left[4S^2\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial Q^2} - 2SH\ .\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial Q^2} - 4SHa\ .\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial Q}\right.$$

$$\left. + 2H^2 a^2 \beta.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_y}{\partial Q}\right]$$

$$+\frac{B_{33}}{\beta^2}.\left[4S^2\left(\frac{\partial^2 w}{\partial R\partial Q}\right)^2 - 2SHa.\left(\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial Q} + \beta\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial R}\right)\right.$$

$$\left. + H^2 a^2.\left(\left(\frac{\partial \phi_x}{\partial Q}\right)^2 + 2\beta\frac{\partial \phi_x}{\partial Q}.\frac{\partial \phi_y}{\partial R} + \beta^2.\left(\frac{\partial \phi_y}{\partial R}\right)^2\right)\right] + a^2 B_{44}.\left(\frac{a}{t}\right)^2.\left[\frac{\partial H}{\partial S}\right]^2.\emptyset_x{}^2$$

$$+ a^2 B_{55}.\left(\frac{a}{t}\right)^2.\left[\frac{\partial H}{\partial S}\right]^2.\emptyset_y{}^2\Bigg\} \qquad 3.76c$$

Integrating Equation 3.76c in closed domain with respect to S gives the expression of Equation 3.77

$$\int_{-0.5}^{0.5} \sigma . \varepsilon \, dS = \frac{E_0 t^2}{[1-\mu_{xy}\mu_{yx}]a^4} \Bigg\{ B_{11} . \left[J_1 \left(\frac{\partial^2 w}{\partial R^2}\right)^2 - 2J_2 a . \frac{\partial^2 w}{\partial R^2} . \frac{\partial \phi_x}{\partial R} + J_3 a^2 . \left(\frac{\partial \phi_x}{\partial R}\right)^2 \right]$$

$$+ \frac{B_{12}}{\beta^2} . \left[2J_1 \left(\frac{\partial^2 w}{\partial R \, \partial Q}\right)^2 - \frac{J_2 a}{\beta} \frac{\partial^2 w}{\partial Q^2} . \frac{\partial \phi_y}{\partial Q} - J_2 a \beta^2 \frac{\partial^2 w}{\partial R^2} . \frac{\partial \phi_x}{\partial R} - J_2 a . \frac{\partial \phi_x}{\partial R} . \frac{\partial^2 w}{\partial Q^2} \right.$$

$$\left. - J_2 a \beta . \frac{\partial^2 w}{\partial R^2} . \frac{\partial \phi_y}{\partial Q} + 2J_3 a^2 \beta . \frac{\partial \phi_x}{\partial R} . \frac{\partial \phi_y}{\partial Q} \right]$$

$$+ \frac{B_{13}}{\beta} . \left[4J_1 \frac{\partial^2 w}{\partial R \partial Q} . \frac{\partial^2 w}{\partial R^2} - 2J_2 a . \left(\frac{\partial \phi_x}{\partial Q} + \beta . \frac{\partial \phi_y}{\partial R} \right) . \frac{\partial^2 w}{\partial R^2} - 4J_2 a \frac{\partial^2 w}{\partial R \partial Q} . \frac{\partial \phi_x}{\partial R} \right.$$

$$\left. + 2J_3 a^2 . \left(\frac{\partial \phi_x}{\partial Q} + \beta . \frac{\partial \phi_y}{\partial R} \right) . \frac{\partial \phi_x}{\partial R} \right]$$

$$+ \frac{B_{22}}{\beta^4} . \left[J_1 \left(\frac{\partial^2 w}{\partial Q^2}\right)^2 - 2J_2 a \beta . \frac{\partial^2 w}{\partial Q^2} . \frac{\partial \phi_y}{\partial Q} + J_3 a^2 \beta^2 . \left(\frac{\partial \phi_y}{\partial Q}\right)^2 \right]$$

$$+ \frac{B_{23}}{\beta^3} . \left[4J_1 \frac{\partial^2 w}{\partial R \partial Q} . \frac{\partial^2 w}{\partial Q^2} - 2J_2 a . \left(\frac{\partial \phi_x}{\partial Q} + \beta . \frac{\partial \phi_y}{\partial R} \right) . \frac{\partial^2 w}{\partial Q^2} - 4J_2 a \beta . \frac{\partial^2 w}{\partial R \partial Q} . \frac{\partial \phi_y}{\partial Q} \right.$$

$$\left. + 2J_3 a^2 \beta . \left(\frac{\partial \phi_x}{\partial Q} + \beta . \frac{\partial \phi_y}{\partial R} \right) . \frac{\partial \phi_y}{\partial Q} \right]$$

$$+ \frac{B_{33}}{\beta^2} . \left[4J_1 \left(\frac{\partial^2 w}{\partial R \partial Q}\right)^2 - 2J_2 a . \left(\frac{\partial^2 w}{\partial R \partial Q} . \frac{\partial \phi_x}{\partial Q} + \beta \frac{\partial^2 w}{\partial R \partial Q} . \frac{\partial \phi_y}{\partial R} \right) \right.$$

$$\left. + J_3 a^2 . \left(\left(\frac{\partial \phi_x}{\partial Q}\right)^2 + 2\beta \frac{\partial \phi_x}{\partial Q} . \frac{\partial \phi_y}{\partial R} + \beta^2 . \left(\frac{\partial \phi_y}{\partial R}\right)^2 \right) \right] + a^2 B_{44} . \left(\frac{a}{t}\right)^2 . J_4 . \emptyset_x^{\,2}$$

$$+ a^2 B_{55} . \left(\frac{a}{t}\right)^2 . J_4 . \emptyset_y^{\,2} \Bigg\} \qquad 3.77$$

Where J_1, J_2, J_3 and J_4 are expressed as shown in Equations 3.78, 3.79, 3.80 and 3.81

$$J_1 = \int_{-0.5}^{0.5} S^2 \, dS = \frac{1}{12} \qquad 3.78$$

$$J_2 = \int_{-0.5}^{0.5} SH \, dS = \int_{-0.5}^{0.5} \left[S^2 - \frac{4}{3} S^4 \right] dS = \left[\frac{S^3}{3} - \frac{4}{15} S^5 \right]_{-0.5}^{0.5}$$

That is:

$$J_2 = \frac{1}{15} \qquad 3.79$$

$$J_3 = \int_{-0.5}^{0.5} H^2 \, \mathrm{dS} = \int_{-0.5}^{0.5} \left[S^2 - \frac{8}{3}S^4 + \frac{16}{9}S^6\right] \mathrm{dS} = \left[\frac{S^3}{3} - \frac{8}{15}S^5 + \frac{16}{63}S^7\right]_{-0.5}^{0.5}$$

That is:

$$J_3 = \frac{17}{315} \qquad 3.80$$

$$J_4 = \int_{-0.5}^{0.5} \left[\frac{\partial H}{\partial S}\right]^2 \mathrm{dS} = \int_{-0.5}^{0.5} [1 - 8S^2 + 16S^4] \, \mathrm{dS} = \left[S - 8\frac{S^3}{3} + 16\frac{S^5}{5}\right]_{-0.5}^{0.5}$$

That is:

$$J_4 = \frac{8}{15} \qquad 3.81$$

Let the ratios of J_i to J_1 be denoted as g_i as expressed in Equations 3.82, 3.83 and 3.84

$$g_2 = \frac{J_2}{J_1} = \frac{1}{15}\Big/\frac{1}{12} = \frac{1 \times 12}{15} = \frac{4}{5} \qquad 3.82$$

$$g_3 = \frac{J_3}{J_1} = \frac{17}{315}\Big/\frac{1}{12} = \frac{17 \times 12}{315} = \frac{68}{105} \qquad 3.83$$

$$g_4 = \frac{J_4}{J_1} = \frac{8}{15}\Big/\frac{1}{12} = \frac{8 \times 12}{15} = 6.4 \qquad 3.8$$

Equation 3.77 can be rewritten to give Equation 3.85 as shown

$$\int_{-0.5}^{0.5} \sigma.\varepsilon\, dS = \frac{E_0 t^2 J_1}{[1-\mu_{xy}\mu_{yx}]a^4} \Bigg\{ B_{11}.\left[\left(\frac{\partial^2 w}{\partial R^2}\right)^2 - 2\frac{J_2}{J_1}a.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} + \frac{J_3}{J_1}a^2.\left(\frac{\partial \phi_x}{\partial R}\right)^2\right]$$

$$+\frac{B_{12}}{\beta^2}.\left[2\left(\frac{\partial^2 w}{\partial R\,\partial Q}\right)^2 - \frac{J_2}{J_1}\frac{a}{\beta}\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} - \frac{J_2}{J_1}a\beta^2\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} - \frac{J_2}{J_1}a.\frac{\partial \phi_x}{\partial R}.\frac{\partial^2 w}{\partial Q^2}\right.$$

$$\left. -\frac{J_2}{J_1}a\beta.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_y}{\partial Q} + 2\frac{J_3}{J_1}a^2\beta.\frac{\partial \phi_x}{\partial R}.\frac{\partial \phi_y}{\partial Q}\right]$$

$$+\frac{B_{13}}{\beta}.\left[4\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial R^2} - 2\frac{J_2}{J_1}a.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial R^2} - 4\frac{J_2}{J_1}a\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial R}\right.$$

$$\left. + 2\frac{J_3}{J_1}a^2.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_x}{\partial R}\right]$$

$$+\frac{B_{22}}{\beta^4}.\left[\left(\frac{\partial^2 w}{\partial Q^2}\right)^2 - 2\frac{J_2}{J_1}a\beta.\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} + \frac{J_3}{J_1}a^2\beta^2.\left(\frac{\partial \phi_y}{\partial Q}\right)^2\right]$$

$$+\frac{B_{23}}{\beta^3}.\left[4\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial Q^2} - 2\frac{J_2}{J_1}a.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial Q^2} - 4\frac{J_2}{J_1}a\beta.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial Q}\right.$$

$$\left. + 2\frac{J_3}{J_1}a^2\beta.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_y}{\partial Q}\right]$$

$$+\frac{B_{33}}{\beta^2}.\left[4\left(\frac{\partial^2 w}{\partial R\partial Q}\right)^2 - 2\frac{J_2}{J_1}a.\left(\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial Q} + \beta\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial R}\right)\right.$$

$$\left. +\frac{J_3}{J_1}a^2.\left(\left(\frac{\partial \phi_x}{\partial Q}\right)^2 + 2\beta\frac{\partial \phi_x}{\partial Q}.\frac{\partial \phi_y}{\partial R} + \beta^2.\left(\frac{\partial \phi_y}{\partial R}\right)^2\right)\right] + a^2 B_{44}.\left(\frac{a}{t}\right)^2.\frac{J_4}{J_1}.\emptyset_x{}^2$$

$$+ a^2 B_{55}.\left(\frac{a}{t}\right)^2.\frac{J_4}{J_1}.\emptyset_y{}^2\Bigg\} \qquad 3.85$$

Rewriting Equation 3.85 by using the definitions on Equations 3.82, 3.83 and 3.84 gives Equation 3.86a

$$\int_{-0.5}^{0.5} \sigma.\varepsilon\, dS = \frac{E_0 t^2 J_1}{[1-\mu_{xy}\mu_{yx}]a^4}\Bigg\{B_{11}.\left[\left(\frac{\partial^2 w}{\partial R^2}\right)^2 - 2g_2 a.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} + g_3 a^2.\left(\frac{\partial \phi_x}{\partial R}\right)^2\right]$$

$$+\frac{B_{12}}{\beta^2}.\left[2\left(\frac{\partial^2 w}{\partial R\,\partial Q}\right)^2 - g_2\frac{a}{\beta}\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} - g_2 a\beta^2\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} - g_2 a.\frac{\partial \phi_x}{\partial R}.\frac{\partial^2 w}{\partial Q^2}\right.$$

$$\left.- g_2 a\beta.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_y}{\partial Q} + 2g_3 a^2\beta.\frac{\partial \phi_x}{\partial R}.\frac{\partial \phi_y}{\partial Q}\right]$$

$$+\frac{B_{13}}{\beta}.\left[4\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial R^2} - 2g_2 a.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial R^2} - 4g_2 a\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial R}\right.$$

$$\left.+ 2g_3 a^2.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_x}{\partial R}\right]$$

$$+\frac{B_{22}}{\beta^4}.\left[\left(\frac{\partial^2 w}{\partial Q^2}\right)^2 - 2g_2 a\beta.\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} + g_3 a^2\beta^2.\left(\frac{\partial \phi_y}{\partial Q}\right)^2\right]$$

$$+\frac{B_{23}}{\beta^3}.\left[4\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial Q^2} - 2g_2 a.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial Q^2} - 4g_2 a\beta.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial Q}\right.$$

$$\left.+ 2g_3 a^2\beta.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_y}{\partial Q}\right]$$

$$+\frac{B_{33}}{\beta^2}.\left[4\left(\frac{\partial^2 w}{\partial R\partial Q}\right)^2 - 2g_2 a.\left(\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial Q} + \beta\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial R}\right)\right.$$

$$\left.+ g_3 a^2.\left(\left(\frac{\partial \phi_x}{\partial Q}\right)^2 + 2\beta\frac{\partial \phi_x}{\partial Q}.\frac{\partial \phi_y}{\partial R} + \beta^2.\left(\frac{\partial \phi_y}{\partial R}\right)^2\right)\right] + a^2 B_{44}.\left(\frac{a}{t}\right)^2.g_4.\emptyset_x{}^2$$

$$+ a^2 B_{55}.\left(\frac{a}{t}\right)^2.g_4.\emptyset_y{}^2\Bigg\} \qquad 3.86a$$

Equation 3.86a can be rewritten to obtain Equation 3.86b

$$\int_{-0.5}^{0.5} \sigma.\varepsilon\, dS = \frac{E_0 t^2}{12[1-\mu_{xy}\mu_{yx}]a^4}\left\{B_{11}.\left[\left(\frac{\partial^2 w}{\partial R^2}\right)^2 - 2g_2 a.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} + g_3 a^2.\left(\frac{\partial \phi_x}{\partial R}\right)^2\right]\right.$$

$$+\frac{B_{12}}{\beta^2}.\left[2\left(\frac{\partial^2 w}{\partial R\,\partial Q}\right)^2 - g_2\frac{a}{\beta}\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} - g_2 a\beta^2\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} - g_2 a.\frac{\partial \phi_x}{\partial R}.\frac{\partial^2 w}{\partial Q^2}\right.$$

$$\left.- g_2 a\beta.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_y}{\partial Q} + 2g_3 a^2\beta.\frac{\partial \phi_x}{\partial R}.\frac{\partial \phi_y}{\partial Q}\right]$$

$$+\frac{B_{13}}{\beta}.\left[4\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial R^2} - 2g_2 a.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial R^2} - 4g_2 a\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial R}\right.$$

$$\left.+ 2g_3 a^2.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_x}{\partial R}\right]$$

$$+\frac{B_{22}}{\beta^4}.\left[\left(\frac{\partial^2 w}{\partial Q^2}\right)^2 - 2g_2 a\beta.\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} + g_3 a^2\beta^2.\left(\frac{\partial \phi_y}{\partial Q}\right)^2\right]$$

$$+\frac{B_{23}}{\beta^3}.\left[4\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial Q^2} - 2g_2 a.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial Q^2} - 4g_2 a\beta.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial Q}\right.$$

$$\left.+ 2g_3 a^2\beta.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_y}{\partial Q}\right]$$

$$+\frac{B_{33}}{\beta^2}.\left[4\left(\frac{\partial^2 w}{\partial R\partial Q}\right)^2 - 2g_2 a.\left(\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial Q} + \beta\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial R}\right)\right.$$

$$\left.+ g_3 a^2.\left(\left(\frac{\partial \phi_x}{\partial Q}\right)^2 + 2\beta\frac{\partial \phi_x}{\partial Q}.\frac{\partial \phi_y}{\partial R} + \beta^2.\left(\frac{\partial \phi_y}{\partial R}\right)^2\right)\right] + a^2 B_{44}.\left(\frac{a}{t}\right)^2.g_4.\emptyset_x{}^2$$

$$\left. + a^2 B_{55}.\left(\frac{a}{t}\right)^2.g_4.\emptyset_y{}^2\right\} \qquad 3.86b$$

Substituting Equation 3.86b into Equation 3.70b gives the strain energy equation as expressed in Equation 3.87a

$$
\begin{aligned}
U = {} & \frac{\mathrm{ab}}{2}\cdot\frac{\mathrm{E_0 t^3}}{12\left[1-\mu_{xy}\mu_{yx}\right]a^4}\int_0^1\int_0^1\left\{\mathrm{B}_{11}\cdot\left[\left(\frac{\partial^2 w}{\partial R^2}\right)^2 - 2g_2 a.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} + g_3 a^2.\left(\frac{\partial \phi_x}{\partial R}\right)^2\right]\right. \\
& + \frac{\mathrm{B}_{12}}{\beta^2}\cdot\left[2\left(\frac{\partial^2 w}{\partial R\,\partial Q}\right)^2 - g_2\frac{a}{\beta}\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} - g_2 a\beta^2\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} - g_2 a.\frac{\partial \phi_x}{\partial R}.\frac{\partial^2 w}{\partial Q^2}\right. \\
& \left. - g_2 a\beta.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_y}{\partial Q} + 2g_3 a^2\beta.\frac{\partial \phi_x}{\partial R}.\frac{\partial \phi_y}{\partial Q}\right] \\
& + \frac{B_{13}}{\beta}\cdot\left[4\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial R^2} - 2g_2 a.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial R^2} - 4g_2 a\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial R}\right. \\
& \left. + 2g_3 a^2.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_x}{\partial R}\right] \\
& + \frac{\mathrm{B}_{22}}{\beta^4}\cdot\left[\left(\frac{\partial^2 w}{\partial Q^2}\right)^2 - 2g_2 a\beta.\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} + g_3 a^2\beta^2.\left(\frac{\partial \phi_y}{\partial Q}\right)^2\right] \\
& + \frac{B_{23}}{\beta^3}\cdot\left[4\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial Q^2} - 2g_2 a.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial Q^2} - 4g_2 a\beta.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial Q}\right. \\
& \left. + 2g_3 a^2\beta.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_y}{\partial Q}\right] \\
& + \frac{\mathrm{B}_{33}}{\beta^2}.\left[4\left(\frac{\partial^2 w}{\partial R\partial Q}\right)^2 - 2g_2 a.\left(\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial Q} + \beta\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial R}\right)\right. \\
& \left. + g_3 a^2.\left(\left(\frac{\partial \phi_x}{\partial Q}\right)^2 + 2\beta\frac{\partial \phi_x}{\partial Q}.\frac{\partial \phi_y}{\partial R} + \beta^2.\left(\frac{\partial \phi_y}{\partial R}\right)^2\right)\right] + a^2\mathrm{B}_{44}.\left(\frac{a}{t}\right)^2.g_4.\emptyset_x^{\,2} \\
& \left. + a^2\mathrm{B}_{55}.\left(\frac{a}{t}\right)^2.g_4.\emptyset_y^{\,2}\right\}\mathrm{dR\,dQ} \qquad 3.87a
\end{aligned}
$$

Equation 3.87a can be simplified to obtain the expression of Equation 3.87b

$$U = \frac{abD_0}{2a^4} \cdot \int_0^1 \int_0^1 \left\{ B_{11} \cdot \left[\left(\frac{\partial^2 w}{\partial R^2} \right)^2 - 2g_2 a. \frac{\partial^2 w}{\partial R^2} \cdot \frac{\partial \phi_x}{\partial R} + g_3 a^2 . \left(\frac{\partial \phi_x}{\partial R} \right)^2 \right] \right.$$

$$+ \frac{B_{12}}{\beta^2} \cdot \left[2 \left(\frac{\partial^2 w}{\partial R\, \partial Q} \right)^2 - g_2 \frac{a}{\beta} \frac{\partial^2 w}{\partial Q^2} \cdot \frac{\partial \phi_y}{\partial Q} - g_2 a \beta^2 \frac{\partial^2 w}{\partial R^2} \cdot \frac{\partial \phi_x}{\partial R} - g_2 a. \frac{\partial \phi_x}{\partial R} \cdot \frac{\partial^2 w}{\partial Q^2} \right.$$

$$\left. - g_2 a \beta. \frac{\partial^2 w}{\partial R^2} \cdot \frac{\partial \phi_y}{\partial Q} + 2 g_3 a^2 \beta. \frac{\partial \phi_x}{\partial R} \cdot \frac{\partial \phi_y}{\partial Q} \right]$$

$$+ \frac{B_{13}}{\beta} \cdot \left[4 \frac{\partial^2 w}{\partial R \partial Q} \cdot \frac{\partial^2 w}{\partial R^2} - 2 g_2 a. \left(\frac{\partial \phi_x}{\partial Q} + \beta. \frac{\partial \phi_y}{\partial R} \right) . \frac{\partial^2 w}{\partial R^2} - 4 g_2 a \frac{\partial^2 w}{\partial R \partial Q} \cdot \frac{\partial \phi_x}{\partial R} \right.$$

$$\left. + 2 g_3 a^2 . \left(\frac{\partial \phi_x}{\partial Q} + \beta. \frac{\partial \phi_y}{\partial R} \right) . \frac{\partial \phi_x}{\partial R} \right]$$

$$+ \frac{B_{22}}{\beta^4} \cdot \left[\left(\frac{\partial^2 w}{\partial Q^2} \right)^2 - 2 g_2 a \beta. \frac{\partial^2 w}{\partial Q^2} \cdot \frac{\partial \phi_y}{\partial Q} + g_3 a^2 \beta^2 . \left(\frac{\partial \phi_y}{\partial Q} \right)^2 \right]$$

$$+ \frac{B_{23}}{\beta^3} \cdot \left[4 \frac{\partial^2 w}{\partial R \partial Q} \cdot \frac{\partial^2 w}{\partial Q^2} - 2 g_2 a. \left(\frac{\partial \phi_x}{\partial Q} + \beta. \frac{\partial \phi_y}{\partial R} \right) . \frac{\partial^2 w}{\partial Q^2} - 4 g_2 a \beta. \frac{\partial^2 w}{\partial R \partial Q} \cdot \frac{\partial \phi_y}{\partial Q} \right.$$

$$\left. + 2 g_3 a^2 \beta. \left(\frac{\partial \phi_x}{\partial Q} + \beta. \frac{\partial \phi_y}{\partial R} \right) . \frac{\partial \phi_y}{\partial Q} \right]$$

$$+ \frac{B_{33}}{\beta^2} . \left[4 \left(\frac{\partial^2 w}{\partial R \partial Q} \right)^2 - 2 g_2 a. \left(\frac{\partial^2 w}{\partial R \partial Q} \cdot \frac{\partial \phi_x}{\partial Q} + \beta \frac{\partial^2 w}{\partial R \partial Q} \cdot \frac{\partial \phi_y}{\partial R} \right) \right.$$

$$\left. + g_3 a^2 . \left(\left(\frac{\partial \phi_x}{\partial Q} \right)^2 + 2\beta \frac{\partial \phi_x}{\partial Q} \cdot \frac{\partial \phi_y}{\partial R} + \beta^2 . \left(\frac{\partial \phi_y}{\partial R} \right)^2 \right) \right] + a^2 B_{44} . \left(\frac{a}{t} \right)^2 . g_4 . \emptyset_x{}^2$$

$$\left. + a^2 B_{55} . \left(\frac{a}{t} \right)^2 . g_4 . \emptyset_y{}^2 \right\} dR\, dQ \qquad 3.87b$$

Where D_0 can be expressed to obtain the values of Equation 3.88

$$D_0 = \frac{E_0 t^3}{12[1 - \mu_{xy}\mu_{yx}]} \qquad 3.88$$

External work on thick rectangular plate in pure bending is given as expressed in Equation 3.89

$$V = -q \int_0^1 \int_0^1 w\, dx\, dy \qquad 3.89$$

Equation 3.89 can be expressed in a nondimensional form as expressed in Equation 3.90

$$V = -qab \int_0^1 \int_0^1 w \, dR \, dQ \qquad 3.90$$

The total potential energy functional of thick rectangular anisotropic plate in pure bending is given as the algebraic sum of the strain energy and external work as expressed in Equation 3.91

$$\Pi = U + V \qquad 3.91$$

Substituting Equations 3.88 and 3.90 into Equation 3.91 gives the expression of Equation 3.92

$$\Pi = \frac{abD_0}{2a^4}.\int_0^1\int_0^1 \Bigg\{\Bigg\{B_{11}.\left[\left(\frac{\partial^2 w}{\partial R^2}\right)^2 - 2g_2a.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} + g_3a^2.\left(\frac{\partial \phi_x}{\partial R}\right)^2\right]$$

$$+\frac{B_{12}}{\beta^2}.\left[2\left(\frac{\partial^2 w}{\partial R\,\partial Q}\right)^2 - g_2\frac{a}{\beta}\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} - g_2a\beta^2\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} - g_2a.\frac{\partial \phi_x}{\partial R}.\frac{\partial^2 w}{\partial Q^2}\right.$$

$$\left. - g_2a\beta.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_y}{\partial Q} + 2g_3a^2\beta.\frac{\partial \phi_x}{\partial R}.\frac{\partial \phi_y}{\partial Q}\right]$$

$$+\frac{B_{13}}{\beta}.\left[4\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial R^2} - 2g_2a.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial R^2} - 4g_2a\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial R}\right.$$

$$\left. + 2g_3a^2.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_x}{\partial R}\right]$$

$$+\frac{B_{22}}{\beta^4}.\left[\left(\frac{\partial^2 w}{\partial Q^2}\right)^2 - 2g_2a\beta.\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} + g_3a^2\beta^2.\left(\frac{\partial \phi_y}{\partial Q}\right)^2\right]$$

$$+\frac{B_{23}}{\beta^3}.\left[4\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial Q^2} - 2g_2a.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial Q^2} - 4g_2a\beta.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial Q}\right.$$

$$\left. + 2g_3a^2\beta.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_y}{\partial Q}\right]$$

$$+\frac{B_{33}}{\beta^2}.\left[4\left(\frac{\partial^2 w}{\partial R\partial Q}\right)^2 - 2g_2a.\left(\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial Q} + \beta\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial R}\right)\right.$$

$$\left. + g_3a^2.\left(\left(\frac{\partial \phi_x}{\partial Q}\right)^2 + 2\beta\frac{\partial \phi_x}{\partial Q}.\frac{\partial \phi_y}{\partial R} + \beta^2.\left(\frac{\partial \phi_y}{\partial R}\right)^2\right)\right] + a^2B_{44}.\left(\frac{a}{t}\right)^2.g_4.\phi_x^{\,2}$$

$$+ a^2B_{55}.\left(\frac{a}{t}\right)^2.g_4.\phi_y^{\,2}\Bigg\} - 2\frac{qa^4}{D_0}w\Bigg\}\,dR\,dQ \qquad 3.92$$

Equation 3.92 is the total potential energy functional for thick anisotropic rectangular plate.

3.2 Formulation of governing equation and compatibility equations

To obtain the equations of equilibrium of forces, Equation 3.92 was differentiated with respect to w, ϕ_x and ϕ_y. That is:

$$\frac{\mathrm{d}\Pi}{\mathrm{dw}} = \frac{\mathrm{d}\Pi}{\mathrm{d}\emptyset_x} = \frac{\mathrm{d}\Pi}{\mathrm{d}\emptyset_y} = 0 \qquad 3.93$$

Minimizing the total potential energy functional (Equation 3.92) with respect to deflection (w) gives the expression of Equation 3.94 as shown

$$\frac{\mathrm{d}\Pi}{\mathrm{dw}} = \frac{\mathrm{abD_0}}{2a^4}\cdot\int_0^1\int_0^1\Bigg\{\Bigg\{\mathrm{B_{11}}\cdot\left[2\frac{\partial^4 w}{\partial R^4} - 2g_2a.\frac{\partial^3\phi_x}{\partial R^3}\right] + \frac{\mathrm{B_{12}}}{\beta^2}\cdot\left[4\frac{\partial^4 w}{\partial R^2\,\partial Q^2} - g_2\frac{a}{\beta}\frac{\partial^3\phi_y}{\partial Q^3} - g_2a\beta^2\frac{\partial^3\phi_x}{\partial R^3} - g_2a.\frac{\partial^3\phi_x}{\partial R\,\partial Q^2} - g_2a\beta.\frac{\partial^3\phi_y}{\partial R^2\partial Q}\right] + \frac{B_{13}}{\beta}\cdot\left[8\frac{\partial^4 w}{\partial R^3\partial Q} - 2g_2a.\left(\frac{\partial^3\phi_x}{\partial R^2\partial Q} + \beta.\frac{\partial^3\phi_y}{\partial R^3}\right) - 4g_2a\frac{\partial^3\phi_x}{\partial R^2\partial Q}\right] + \frac{\mathrm{B_{22}}}{\beta^4}\cdot\left[2\frac{\partial^4 w}{\partial Q^4} - 2g_2a\beta.\frac{\partial^3\phi_y}{\partial Q^3}\right] + \frac{B_{23}}{\beta^3}\cdot\left[8\frac{\partial^4 w}{\partial R\partial Q^3} - 2g_2a.\left(\frac{\partial^3\phi_x}{\partial Q^3} + \beta.\frac{\partial^3\phi_y}{\partial R\partial Q^2}\right) - 4g_2a\beta.\frac{\partial^3\phi_y}{\partial R\partial Q^2}\right] + \frac{\mathrm{B_{33}}}{\beta^2}\cdot\left[8\frac{\partial^4 w}{\partial R^2\,\partial Q^2} - 2g_2a.\left(\frac{\partial^3\phi_x}{\partial R\,\partial Q^2} + \beta\frac{\partial^3\phi_y}{\partial R^2\partial Q}\right)\right]\Bigg\} - 2\frac{\mathrm{q}a^4}{\mathrm{D_0}}\Bigg\}\,\mathrm{dR\,dQ} = 0 \qquad 3.94a$$

That is:

$$\int_0^1\int_0^1\Bigg\{2\frac{\partial^4 w}{\partial R^4}\mathrm{B_{11}} - 2g_2a.\frac{\partial^3\phi_x}{\partial R^3}\mathrm{B_{11}} + 4\frac{\partial^4 w}{\partial R^2\,\partial Q^2}\frac{\mathrm{B_{12}}}{\beta^2} - g_2\frac{a}{\beta}\frac{\partial^3\phi_y}{\partial Q^3}\frac{\mathrm{B_{12}}}{\beta^2} - g_2a\beta^2\frac{\partial^3\phi_x}{\partial R^3}\frac{\mathrm{B_{12}}}{\beta^2} - g_2a.\frac{\partial^3\phi_x}{\partial R\,\partial Q^2}\frac{\mathrm{B_{12}}}{\beta^2} - g_2a\beta.\frac{\partial^3\phi_y}{\partial R^2\partial Q}\frac{\mathrm{B_{12}}}{\beta^2} + 8\frac{\partial^4 w}{\partial R^3\partial Q}\frac{B_{13}}{\beta} - 2g_2a.\frac{\partial^3\phi_x}{\partial R^2\partial Q}\frac{B_{13}}{\beta} - 2g_2a.\beta.\frac{\partial^3\phi_y}{\partial R^3}\frac{B_{13}}{\beta} - 4g_2a\frac{\partial^3\phi_x}{\partial R^2\partial Q}\frac{B_{13}}{\beta} + 2\frac{\partial^4 w}{\partial Q^4}\frac{\mathrm{B_{22}}}{\beta^4} - 2g_2a\beta.\frac{\partial^3\phi_y}{\partial Q^3}\frac{\mathrm{B_{22}}}{\beta^4} + 8\frac{\partial^4 w}{\partial R\partial Q^3}\frac{B_{23}}{\beta^3} - 2g_2a.\frac{\partial^3\phi_x}{\partial Q^3}\frac{B_{23}}{\beta^3} - 2g_2a.\beta.\frac{\partial^3\phi_y}{\partial R\partial Q^2}\frac{B_{23}}{\beta^3} - 4g_2a\beta.\frac{\partial^3\phi_y}{\partial R\partial Q^2}\frac{B_{23}}{\beta^3} + 8\frac{\partial^4 w}{\partial R^2\,\partial Q^2}\frac{\mathrm{B_{33}}}{\beta^2} - 2g_2a.\frac{\partial^3\phi_x}{\partial R\,\partial Q^2}\frac{\mathrm{B_{33}}}{\beta^2} - 2g_2a.\beta\frac{\partial^3\phi_y}{\partial R^2\partial Q}\frac{\mathrm{B_{33}}}{\beta^2} - 2\frac{\mathrm{q}a^4}{\mathrm{D_0}}\Bigg\}\,\mathrm{dR\,dQ} = 0 \qquad 3.94b$$

That is:

$$\int_0^1\int_0^1 \Bigg\{ B_{11}.\frac{\partial^4 w}{\partial R^4} + \frac{2}{\beta^2}\,[B_{12} + 2B_{33}]\frac{\partial^4 w}{\partial R^2\,\partial Q^2} + \frac{B_{22}}{\beta^4}.\frac{\partial^4 w}{\partial Q^4} + 4\frac{\partial^4 w}{\partial R^3 \partial Q}\frac{B_{13}}{\beta} + 4\frac{\partial^4 w}{\partial R \partial Q^3}\frac{B_{23}}{\beta^3}$$

$$- \frac{g_2 a}{2}[2B_{11} + B_{12}]\frac{\partial^3 \phi_x}{\partial R^3} - \frac{g_2 a}{2\beta^2}.[B_{12} + 2B_{33}]\frac{\partial^3 \phi_x}{\partial R\,\partial Q^2} - 3g_2 a.\frac{B_{13}}{\beta}\frac{\partial^3 \phi_x}{\partial R^2 \partial Q}$$

$$- \frac{g_2 a}{2\beta^3}[B_{12} + 2B_{22}]\frac{\partial^3 \phi_y}{\partial Q^3} - \frac{g_2 a}{2\beta}[B_{12} + 2B_{33}]\frac{\partial^3 \phi_y}{\partial R^2 \partial Q} - 3g_2 a.\frac{B_{23}}{\beta^2}\frac{\partial^3 \phi_y}{\partial R \partial Q^2}$$

$$- g_2 a.B_{13}.\frac{\partial^3 \phi_y}{\partial R^3} - \frac{g_2 a}{\beta^3}.B_{23}.\frac{\partial^3 \phi_x}{\partial Q^3} - \frac{q a^4}{D_0}\Bigg\} dR\,dQ = 0 \qquad 3.94c$$

The x-y plane elastic modulus parameter is defined as shown in Equation 3.95

$$B_{xy} = B_{12} + 2B_{33} \qquad 3.95$$

Substituting Equation 3.95 into Equation 3.94 gives the expression of Equation 3.96

$$\int_0^1\int_0^1 \Bigg\{ B_{11}.\frac{\partial^4 w}{\partial R^4} + \frac{2}{\beta^2}.B_{xy}\frac{\partial^4 w}{\partial R^2\,\partial Q^2} + \frac{B_{22}}{\beta^4}.\frac{\partial^4 w}{\partial Q^4} + 4\frac{B_{13}}{\beta}.\frac{\partial^4 w}{\partial R^3 \partial Q} + 4\frac{B_{23}}{\beta^3}.\frac{\partial^4 w}{\partial R \partial Q^3}$$

$$- \frac{g_2 a}{2}[2B_{11} + B_{12}]\frac{\partial^3 \phi_x}{\partial R^3} - \frac{g_2 a}{2\beta^2}.B_{xy}\frac{\partial^3 \phi_x}{\partial R\,\partial Q^2} - 3g_2 a.\frac{B_{13}}{\beta}\frac{\partial^3 \phi_x}{\partial R^2 \partial Q}$$

$$- \frac{g_2 a}{2\beta^3}[B_{12} + 2B_{22}]\frac{\partial^3 \phi_y}{\partial Q^3} - \frac{g_2 a}{2\beta}B_{xy}\frac{\partial^3 \phi_y}{\partial R^2 \partial Q} - 3g_2 a.\frac{B_{23}}{\beta^2}\frac{\partial^3 \phi_y}{\partial R \partial Q^2} - g_2 a.B_{13}.\frac{\partial^3 \phi_y}{\partial R^3}$$

$$- \frac{g_2 a}{\beta^3}.B_{23}.\frac{\partial^3 \phi_x}{\partial Q^3} - \frac{q a^4}{D_0}\Bigg\} dR\,dQ = 0 \qquad 3.96$$

Equation 3.96 is the governing equation of thick anisotropic rectangular plate.

Minimizing the total potential energy functional with respect to x-z plane rotation gives the expression of Equation 3.97

$$\frac{d\Pi}{d\emptyset_x} = \frac{ab\ _0}{2a^4}.\int_0^1\int_0^1 \Bigg\{ B_{11}.\left[-2g_2 a.\frac{\partial^3 w}{\partial R^3} + 2g_3 a^2.\frac{\partial^2 \phi_x}{\partial R^2}\right] + \frac{B_{12}}{\beta^2}.\left[-g_2 a\beta^2\frac{\partial^3 w}{\partial R^3} - g_2 a.\frac{\partial^3 w}{\partial R\,\partial Q^2} +\right.$$

$$\left. 2g_3 a^2 \beta.\frac{\partial^2 \phi_y}{\partial R \partial Q}\right] + \frac{B_{13}}{\beta}.\left[-2g_2 a.\frac{\partial^3 w}{\partial Q\,\partial R^2} - 4g_2 a\frac{\partial^3 w}{\partial Q\,\partial R^2} + 2g_3 a^2.\left(2\frac{\partial^2 \phi_x}{\partial R \partial Q} + \beta.\frac{\partial^2 \phi_y}{\partial R^2}\right)\right] +$$

$$\frac{B_{23}}{\beta^3}.\left[-2g_2 a.\frac{\partial^3 w}{\partial Q^3} + 2g_3 a^2 \beta.\frac{\partial^2 \phi_y}{\partial Q^2}\right] + \frac{B_{33}}{\beta^2}.\left[-2g_2 a.\frac{\partial^3 w}{\partial R\,\partial Q^2} + g_3 a^2.\left(2\frac{\partial^2 \phi_x}{\partial Q^2} + 2\beta\frac{\partial^2 \phi_y}{\partial R \partial Q}\right)\right] +$$

$$2a^2 B_{44}.\left(\frac{a}{t}\right)^2.g_4.\emptyset_x\Bigg\} dR\,dQ = 0 \qquad 3.97a$$

That is:

$$\mathrm{B}_{11}\,.\left[-g_2a.\frac{\partial^3 w}{\partial R^3}+g_3a^2.\frac{\partial^2\phi_x}{\partial R^2}\right]+\frac{\mathrm{B}_{12}}{2\beta^2}\,.\left[-g_2a\beta^2\frac{\partial^3 w}{\partial R^3}-g_2a.\frac{\partial^3 w}{\partial R\,\partial Q^2}+2g_3a^2\beta.\frac{\partial^2\phi_y}{\partial R\partial Q}\right]$$
$$+\frac{B_{13}}{\beta}\,.\left[-g_2a.\frac{\partial^3 w}{\partial Q\,\partial R^2}-2g_2a\frac{\partial^3 w}{\partial Q\,\partial R^2}+2g_3a^2.\frac{\partial^2\phi_x}{\partial R\partial Q}+g_3a^2.\beta.\frac{\partial^2\phi_y}{\partial R^2}\right]$$
$$+\frac{B_{23}}{\beta^3}\,.\left[-g_2a.\frac{\partial^3 w}{\partial Q^3}+g_3a^2\beta.\frac{\partial^2\phi_y}{\partial Q^2}\right]$$
$$+\frac{\mathrm{B}_{33}}{\beta^2}.\left[-g_2a.\frac{\partial^3 w}{\partial R\,\partial Q^2}+g_3a^2.\frac{\partial^2\phi_x}{\partial Q^2}+g_3a^2.\beta\frac{\partial^2\phi_y}{\partial R\partial Q}\right]+a^2\mathrm{B}_{44}.\left(\frac{a}{t}\right)^2.g_4.\emptyset_x$$
$$=0 \qquad 3.97\mathrm{b}$$

Equation 3.97b is the compatibility equation of thick anisotropic rectangular plate on x-z plane rotation.

Minimizing the total potential energy functional with respect to y-z plane rotation gives the expression of Equation 3.98

$$\frac{\mathrm{d}\Pi}{\mathrm{d}\emptyset_{\mathrm{y}}}=\frac{\mathrm{ab}\ \ _0}{2a^4}.\int_0^1\int_0^1\left\{\frac{\mathrm{B}_{12}}{\beta^2}\,.\left[-g_2\frac{a}{\beta}\frac{\partial^3 w}{\partial Q^3}-g_2a\beta.\frac{\partial^3 w}{\partial R^2\partial Q}+2g_3a^2\beta.\frac{\partial^2\phi_x}{\partial R\partial Q}\right]+\frac{B_{13}}{\beta}\,.\left[-2g_2a.\beta.\frac{\partial^3 w}{\partial R^3}+\right.\right.$$
$$\left.2g_3a^2.\beta.\frac{\partial^2\phi_x}{\partial R^2}\right]+\frac{\mathrm{B}_{22}}{\beta^4}\,.\left[-2g_2a\beta.\frac{\partial^3 w}{\partial Q^3}+2g_3a^2\beta^2.\frac{\partial^2\phi_y}{\partial Q^2}\right]+\frac{B_{23}}{\beta^3}\,.\left[-2g_2a.\beta.\frac{\partial^3 w}{\partial R\,\partial Q^2}-4g_2a\beta.\frac{\partial^3 w}{\partial R\partial Q^2}+\right.$$
$$\left.2g_3a^2\beta.\left(\frac{\partial^2\phi_x}{\partial Q^2}+2\beta.\frac{\partial^2\phi_y}{\partial R\partial Q}\right)\right]+\frac{\mathrm{B}_{33}}{\beta^2}.\left[-2g_2a.\beta\frac{\partial^3 w}{\partial R^2\partial Q}+g_3a^2.\left(2\beta\frac{\partial^2\phi_x}{\partial R\partial Q}+2\beta^2.\frac{\partial^2\phi_y}{\partial R^2}\right)\right]+$$
$$\left.2a^2\mathrm{B}_{55}.\left(\frac{a}{t}\right)^2.g_4.\emptyset_y\right\}\mathrm{dR\ dQ}=0 \qquad 3.98\mathrm{a}$$

That is:

$$\frac{B_{12}}{2\beta^2}.\left[-g_2\frac{a}{\beta}\frac{\partial^3 w}{\partial Q^3}-g_2 a\beta.\frac{\partial^3 w}{\partial R^2\partial Q}+2g_3a^2\beta.\frac{\partial^2\phi_x}{\partial R\partial Q}\right]+\frac{B_{13}}{\beta}.\left[-g_2 a.\beta.\frac{\partial^3 w}{\partial R^3}+g_3a^2.\beta.\frac{\partial^2\phi_x}{\partial R^2}\right]$$

$$+\frac{B_{22}}{\beta^4}.\left[-g_2 a\beta.\frac{\partial^3 w}{\partial Q^3}+g_3a^2\beta^2.\frac{\partial^2\phi_y}{\partial Q^2}\right]$$

$$+\frac{B_{23}}{\beta^3}.\left[-g_2 a.\beta.\frac{\partial^3 w}{\partial R\,\partial Q^2}-2g_2 a\beta.\frac{\partial^3 w}{\partial R\partial Q^2}+g_3a^2\beta.\frac{\partial^2\phi_x}{\partial Q^2}+2g_3a^2\beta^2.\frac{\partial^2\phi_y}{\partial R\partial Q}\right]$$

$$+\frac{B_{33}}{\beta^2}.\left[-g_2 a.\beta\frac{\partial^3 w}{\partial R^2\partial Q}+g_3a^2.\beta\frac{\partial^2\phi_x}{\partial R\partial Q}+g_3a^2.\beta^2.\frac{\partial^2\phi_y}{\partial R^2}\right]$$

$$+a^2B_{55}.\left(\frac{a}{t}\right)^2.g_4.\emptyset_y=0 \qquad 3.98b$$

Equation 3.98b is the compatibility equation of thick anisotropic rectangular plate on y-z plane rotation.

Adding Equations 3.97 and 3.98 gives the expression of Equation 3.99

$$B_{11}.\left[-g_2 a.\frac{\partial^3 w}{\partial R^3}+g_3a^2.\frac{\partial^2\phi_x}{\partial R^2}\right]$$

$$+\frac{B_{12}}{2\beta^2}.\left[-g_2 a\beta^2\frac{\partial^3 w}{\partial R^3}-g_2 a.\frac{\partial^3 w}{\partial R\,\partial Q^2}+2g_3a^2\beta.\frac{\partial^2\phi_y}{\partial R\partial Q}-g_2\frac{a}{\beta}\frac{\partial^3 w}{\partial Q^3}\right.$$

$$\left.-g_2 a\beta.\frac{\partial^3 w}{\partial R^2\partial Q}+2g_3a^2\beta.\frac{\partial^2\phi_x}{\partial R\partial Q}\right]$$

$$+\frac{B_{13}}{\beta}.\left[-g_2 a.\frac{\partial^3 w}{\partial Q\,\partial R^2}-2g_2 a\frac{\partial^3 w}{\partial Q\,\partial R^2}+2g_3a^2.\frac{\partial^2\phi_x}{\partial R\partial Q}+g_3a^2.\beta.\frac{\partial^2\phi_y}{\partial R^2}\right.$$

$$\left.-g_2 a.\beta.\frac{\partial^3 w}{\partial R^3}+g_3a^2.\beta.\frac{\partial^2\phi_x}{\partial R^2}\right]+\frac{B_{22}}{\beta^4}.\left[-g_2 a\beta.\frac{\partial^3 w}{\partial Q^3}+g_3a^2\beta^2.\frac{\partial^2\phi_y}{\partial Q^2}\right]$$

$$+\frac{B_{23}}{\beta^3}.\left[-g_2 a.\frac{\partial^3 w}{\partial Q^3}+g_3a^2\beta.\frac{\partial^2\phi_y}{\partial Q^2}-g_2 a.\beta.\frac{\partial^3 w}{\partial R\,\partial Q^2}-2g_2 a\beta.\frac{\partial^3 w}{\partial R\partial Q^2}\right.$$

$$\left.+g_3a^2\beta.\frac{\partial^2\phi_x}{\partial Q^2}+2g_3a^2\beta^2.\frac{\partial^2\phi_y}{\partial R\partial Q}\right]$$

$$+\frac{B_{33}}{\beta^2}.\left[-g_2 a.\frac{\partial^3 w}{\partial R\,\partial Q^2}+g_3a^2.\frac{\partial^2\phi_x}{\partial Q^2}+g_3a^2.\beta\frac{\partial^2\phi_y}{\partial R\partial Q}-g_2 a.\beta\frac{\partial^3 w}{\partial R^2\partial Q}+g_3a^2.\beta\frac{\partial^2\phi_x}{\partial R\partial Q}+\right.$$

$$\left.g_3a^2.\beta^2.\frac{\partial^2\phi_y}{\partial R^2}\right]+a^2B_{44}.\left(\frac{a}{t}\right)^2.g_4.\emptyset_x+a^2B_{55}.\left(\frac{a}{t}\right)^2.g_4.\emptyset_y=0 \qquad 3.99a$$

That is:

$$
\begin{aligned}
&B_{11}\,.\left[-g_2 a.\frac{\partial^3 w}{\partial R^3}+g_3 a^2.\frac{\partial^2 \phi_x}{\partial R^2}\right]\\
&\quad+\frac{B_{12}}{2\beta^2}\,.\left[\left(-g_2 a\beta^2\frac{\partial^3 w}{\partial R^3}-g_2\frac{a}{\beta}\frac{\partial^3 w}{\partial Q^3}\right)+\left(-g_2 a.\frac{\partial^3 w}{\partial R\,\partial Q^2}+2g_3 a^2\beta.\frac{\partial^2 \phi_y}{\partial R\partial Q}\right)\right.\\
&\quad\left.+\left(-g_2 a\beta.\frac{\partial^3 w}{\partial R^2\partial Q}+2g_3 a^2\beta.\frac{\partial^2 \phi_x}{\partial R\partial Q}\right)\right]\\
&\quad+\frac{B_{13}}{\beta}\,.\left[\left(-g_2 a.\frac{\partial^3 w}{\partial Q\,\partial R^2}+g_3 a^2.\beta.\frac{\partial^2 \phi_y}{\partial R^2}\right)+\left(-2g_2 a\frac{\partial^3 w}{\partial Q\,\partial R^2}+2g_3 a^2.\frac{\partial^2 \phi_x}{\partial R\partial Q}\right)\right.\\
&\quad\left.+\left(-g_2 a.\beta.\frac{\partial^3 w}{\partial R^3}+g_3 a^2.\beta.\frac{\partial^2 \phi_x}{\partial R^2}\right)\right]+\frac{B_{22}}{\beta^4}\,.\left[-g_2 a\beta.\frac{\partial^3 w}{\partial Q^3}+g_3 a^2\beta^2.\frac{\partial^2 \phi_y}{\partial Q^2}\right]\\
&\quad+\frac{B_{23}}{\beta^3}\,.\left[\left(-g_2 a.\frac{\partial^3 w}{\partial Q^3}+g_3 a^2\beta.\frac{\partial^2 \phi_y}{\partial Q^2}\right)+\left(+g_3 a^2\beta.\frac{\partial^2 \phi_x}{\partial Q^2}-g_2 a.\beta.\frac{\partial^3 w}{\partial R\,\partial Q^2}\right)\right.\\
&\quad\left.+\left(2g_3 a^2\beta^2.\frac{\partial^2 \phi_y}{\partial R\partial Q}-2g_2 a\beta.\frac{\partial^3 w}{\partial R\partial Q^2}\right)\right]\\
&+\frac{B_{33}}{\beta^2}.\left[\left(-g_2 a.\frac{\partial^3 w}{\partial R\,\partial Q^2}+g_3 a^2.\frac{\partial^2 \phi_x}{\partial Q^2}\right)+\left(-g_2 a.\beta\frac{\partial^3 w}{\partial R^2\partial Q}+g_3 a^2.\beta^2.\frac{\partial^2 \phi_y}{\partial R^2}\right)\right.\\
&\quad\left.+g_3 a^2.\beta\left(\frac{\partial^2 \phi_x}{\partial R\partial Q}+\frac{\partial^2 \phi_y}{\partial R\partial Q}\right)\right]+\left(\frac{a}{t}\right)^2 a^2.g_4\left[B_{44}.\emptyset_x+B_{55}.\emptyset_y\right]=0 \qquad 3.99b
\end{aligned}
$$

Equation 3.99 is the total compatibility equation of thick anisotropic rectangular plate on both x-z and y-z planes.

3.3 Determination of exact polynomial displacement functions and stiffness coefficients

The governing equation (Equation 3.96) and two compatibility equations (Equations 3.97 and 3.98) were solved to obtain the displacement functions (deflection, shear deformation rotation in x direction and shear deformation rotation in y direction). The general displacement functions obtained were used to satisfy the specified boundary conditions to obtain the unique displacement functions for the various plates. The stiffness coefficients were calculated with the unique displacement functions for the various plates.

3.3.1 Determination of exact polynomial displacement functions

One of the possibilities for Equation 3.99 to be zero is for each of the square brackets to be zero. That is, each of the square bracket can be expressed as shown in Equation 3.100 to Equation 3.106

$$\left[-g_2 a.\frac{\partial^3 w}{\partial R^3} + g_3 a^2.\frac{\partial^2 \phi_x}{\partial R^2}\right] = 0 \qquad 3.100$$

$$\left[\left(-g_2 a\beta^2\frac{\partial^3 w}{\partial R^3} - g_2\frac{a}{\beta}\frac{\partial^3 w}{\partial Q^3}\right) + \left(-g_2 a.\frac{\partial^3 w}{\partial R\,\partial Q^2} + 2g_3 a^2\beta.\frac{\partial^2 \phi_y}{\partial R\partial Q}\right) + \left(-g_2 a\beta.\frac{\partial^3 w}{\partial R^2\partial Q} + 2g_3 a^2\beta.\frac{\partial^2 \phi_x}{\partial R\partial Q}\right)\right] = 0 \qquad 3.101$$

$$\left[\left(-g_2 a.\frac{\partial^3 w}{\partial Q\,\partial R^2} + g_3 a^2.\beta.\frac{\partial^2 \phi_y}{\partial R^2}\right) + \left(-2g_2 a\frac{\partial^3 w}{\partial Q\,\partial R^2} + 2g_3 a^2.\frac{\partial^2 \phi_x}{\partial R\partial Q}\right) + \left(-g_2 a.\beta.\frac{\partial^3 w}{\partial R^3} + g_3 a^2.\beta.\frac{\partial^2 \phi_x}{\partial R^2}\right)\right] = 0 \qquad 3.102$$

$$\left[-g_2 a\beta.\frac{\partial^3 w}{\partial Q^3} + g_3 a^2\beta^2.\frac{\partial^2 \phi_y}{\partial Q^2}\right] = 0 \qquad 3.103$$

$$\left[\left(-g_2 a.\frac{\partial^3 w}{\partial Q^3} + g_3 a^2\beta.\frac{\partial^2 \phi_y}{\partial Q^2}\right) + \left(+g_3 a^2\beta.\frac{\partial^2 \phi_x}{\partial Q^2} - g_2 a.\beta.\frac{\partial^3 w}{\partial R\,\partial Q^2}\right) + \left(2g_3 a^2\beta^2.\frac{\partial^2 \phi_y}{\partial R\partial Q} - 2g_2 a\beta.\frac{\partial^3 w}{\partial R\partial Q^2}\right)\right] = 0 \qquad 3.104$$

$$\left[\left(-g_2 a.\frac{\partial^3 w}{\partial R\,\partial Q^2} + g_3 a^2.\frac{\partial^2 \phi_x}{\partial Q^2}\right) + \left(-g_2 a.\beta\frac{\partial^3 w}{\partial R^2\partial Q} + g_3 a^2.\beta^2.\frac{\partial^2 \phi_y}{\partial R^2}\right) + \left(g_3 a^2.\beta\frac{\partial^2 \phi_x}{\partial R\partial Q} + g_3 a^2.\beta\frac{\partial^2 \phi_y}{\partial R\partial Q}\right)\right] = 0 \qquad 3.105$$

$$\left[\mathrm{B}_{44}.\emptyset_x + \mathrm{B}_{55}.\emptyset_y\right] = 0 \qquad 3.106$$

From Equations 3.100, 3.102, 3.104 and 3.105, Equation 3.107 can be obtained as shown

$$\emptyset_x = \frac{g_2}{g_3 a}.\frac{\partial w}{\partial R} = \frac{\mathrm{P}_2}{a}.\frac{\partial w}{\partial R} \qquad 3.107$$

From Equations 3.102, 3.103, 3.104 and 3.105, Equation 3.108 is obtained as expressed

$$\frac{\partial w}{\partial Q} = \frac{P_3}{\alpha\beta}.\frac{\partial w}{\partial Q} \quad 3.108$$

From Equation 3.101, Equation 3.109 is obtained as expressed

$$\frac{\partial^3 w}{\partial R^3} = -\frac{1}{\beta^2}.\frac{\partial^3 w}{\partial Q^3} \quad 3.109$$

From Equations 3.105, Equation 3.110 is obtained as shown

$$\emptyset_x = -\emptyset_y \quad 3.110$$

From Equations 3.106, Equation 3.111 is obtained as expressed

$$\emptyset_x = -\frac{B_{55}}{B_{44}}.\emptyset_y \quad 3.111$$

Equation 3.112 is simply a restatement of equation 3.111.

$$\emptyset_x = -m_1.\emptyset_y \quad 3.112$$

Where m_1 is a constant whose value is to be obtained.

Substituting Equations 3.107 and 3.108 into Equation 3.96 gives the expression of Equation 3.113

$$\int_0^1\int_0^1 \Big\{B_{11}.\frac{\partial^4 w}{\partial R^4} + \frac{2}{\beta^2}.B_{xy}\frac{\partial^4 w}{\partial R^2\,\partial Q^2} + \frac{B_{22}}{\beta^4}.\frac{\partial^4 w}{\partial Q^4} + 4\frac{B_{13}}{\beta}.\frac{\partial^4 w}{\partial R^3\partial Q} + 4\frac{B_{23}}{\beta^3}.\frac{\partial^4 w}{\partial R\partial Q^3} - \frac{{g_2}^2}{2g_3}[2B_{11} + B_{12}]\frac{\partial^4 w}{\partial R^4} - \frac{{g_2}^2}{2g_3\beta^2}.B_{xy}\frac{\partial^4 w}{\partial R^2\,\partial Q^2} - \frac{3{g_2}^2}{g_3}.\frac{B_{13}}{\beta}\frac{\partial^4 w}{\partial R^3\partial Q} - \frac{{g_2}^2}{2g_3\beta^4}[B_{12} + 2B_{22}]\frac{\partial^4 w}{\partial Q^4} - \frac{{g_2}^2}{2g_3\beta^2}B_{xy}\frac{\partial^4 w}{\partial R^2\partial Q^2} - \frac{3{g_2}^2}{g_3}.\frac{B_{23}}{\beta^3}\frac{\partial^4 w}{\partial R\partial Q^3} - \frac{{g_2}^2}{g_3\beta}.B_{13}.\frac{\partial^4 w}{\partial R^3\partial Q} - \frac{{g_2}^2}{g_3\beta^3}.B_{23}.\frac{\partial^4 w}{\partial R\partial Q^3} - \frac{q\alpha^4}{D_0}\Big\}\,dR\,dQ = 0 \quad 3.113a$$

That is:

$$\int_0^1\int_0^1 \Big\{\Big(B_{11} - \frac{{g_2}^2}{g_3}B_{11} - \frac{{g_2}^2}{2g_3}B_{12}\Big)\frac{\partial^4 w}{\partial R^4} + \frac{2}{\beta^2}.\Big(B_{xy} - \frac{{g_2}^2}{2g_3}.B_{xy}\Big)\frac{\partial^4 w}{\partial R^2\partial Q^2} + \frac{1}{\beta^4}.\Big(B_{22} - \frac{{g_2}^2}{2g_3}B_{12} - \frac{{g_2}^2}{g_3}B_{22}\Big)\frac{\partial^4 w}{\partial Q^4} + \frac{B_{13}}{\beta}\Big(4 - \frac{3{g_2}^2}{g_3} - \frac{{g_2}^2}{g_3}\Big)\frac{\partial^4 w}{\partial R^3\partial Q} + \frac{B_{23}}{\beta^3}\Big(4 - \frac{3{g_2}^2}{g_3} - \frac{{g_2}^2}{g_3}\Big)\frac{\partial^4 w}{\partial R\partial Q^3} - \frac{q\alpha^4}{D_0}\Big\}\,dR\,dQ = 0$$

3.113b

That is:

$$\int_0^1\int_0^1\left\{\left(B_{11}-\frac{g_2^{\,2}}{g_3}B_{11}-\frac{g_2^{\,2}}{2g_3}B_{12}\right)\frac{\partial^4 w}{\partial R^4}+\frac{2}{\beta^2}.\left(B_{xy}-\frac{g_2^{\,2}}{2g_3}.B_{xy}\right)\frac{\partial^4 w}{\partial R^2\partial Q^2}\right.$$

$$+\frac{1}{\beta^4}.\left(B_{22}-\frac{g_2^{\,2}}{2g_3}B_{12}-\frac{g_2^{\,2}}{g_3}B_{22}\right)\frac{\partial^4 w}{\partial Q^4}+\ 4\frac{B_{13}}{\beta}\left(1-\frac{g_2^{\,2}}{g_3}\right)\frac{\partial^4 w}{\partial R^3\partial Q}$$

$$\left.+\,4\,\frac{B_{23}}{\beta^3}\left(1-\frac{g_2^{\,2}}{g_3}\right)\frac{\partial^4 w}{\partial R\partial Q^3}-\frac{qa^4}{D_0}\right\}dR\ dQ=0 \qquad 3.113c$$

Dividing Equation 3.113 with $\left(B_{11}-\frac{g_2^{\,2}}{g_3}B_{11}-\frac{g_2^{\,2}}{2g_3}B_{12}\right)$ gives the expression of Equation 3.114

$$\int_0^1\int_0^1\left\{\frac{\partial^4 w}{\partial R^4}+\frac{2m_2}{\beta^2}.\frac{\partial^4 w}{\partial R^2\partial Q^2}+\frac{m_3}{\beta^4}.\frac{\partial^4 w}{\partial Q^4}+\ \frac{m_4}{\beta}\frac{\partial^4 w}{\partial R^3\partial Q}+\ \frac{m_4}{\beta^3}\frac{\partial^4 w}{\partial R\partial Q^3}-\frac{m_5 qa^4}{D_0}\right\}dR\ dQ=0 \quad 3.114$$

Where: m_2, m_3, m_4 and m_5 are as expressed in Equations 3.115, 3.116, 3.117 and 3.118

$$m_2=\frac{\left(B_{xy}-\frac{g_2^{\,2}}{2g_3}.B_{xy}\right)}{\left(B_{11}-\frac{g_2^{\,2}}{g_3}B_{11}-\frac{g_2^{\,2}}{2g_3}B_{12}\right)} \qquad 3.115$$

$$m_3=\frac{\left(B_{22}-\frac{g_2^{\,2}}{2g_3}B_{12}-\frac{g_2^{\,2}}{g_3}B_{22}\right)}{\left(B_{11}-\frac{g_2^{\,2}}{g_3}B_{11}-\frac{g_2^{\,2}}{2g_3}B_{12}\right)} \qquad 3.116$$

$$m_4=\frac{4B_{23}\left(1-\frac{g_2^{\,2}}{g_3}\right)}{\left(B_{11}-\frac{g_2^{\,2}}{g_3}B_{11}-\frac{g_2^{\,2}}{2g_3}B_{12}\right)} \qquad 3.117$$

$$m_5=\frac{1}{\left(B_{11}-\frac{g_2^{\,2}}{g_3}B_{11}-\frac{g_2^{\,2}}{2g_3}B_{12}\right)} \qquad 3.117$$

Rewriting Equation 3.114 gives the expression of Equation 3.118

$$\int_0^1\int_0^1\left\{\left[\frac{\partial^4 w}{\partial R^4}+\frac{2m_2}{\beta^2}.\frac{\partial^4 w}{\partial R^2\partial Q^2}+\frac{m_3}{\beta^4}.\frac{\partial^4 w}{\partial Q^4}-\frac{m_5 qa^4}{D_0}\right]+\frac{m_4}{\beta}.\frac{\partial^2}{\partial R\partial Q}\left[\frac{\partial^2 w}{\partial R^2}+\ \frac{1}{\beta^2}\frac{\partial^2 w}{\partial Q^2}\right]\right\}dR\ dQ$$

$$=0 \qquad 3.118$$

One of the possibilities for Equation 3.118 to be true is as expressed in Equations 3.119 and 3.120

$$\int_0^1\int_0^1 \left[\frac{\partial^4 w}{\partial R^4} + \frac{2m_2}{\beta^2}.\frac{\partial^4 w}{\partial R^2 \partial Q^2} + \frac{m_3}{\beta^4}.\frac{\partial^4 w}{\partial Q^4} - \frac{m_5 q a^4}{D_0}\right] dR\, dQ = 0 \qquad 3.119$$

and

$$\int_0^1\int_0^1 \left[\frac{\partial^2 w}{\partial R^2} + \frac{1}{\beta^2}\frac{\partial^2 w}{\partial Q^2}\right] dR\, dQ = 0 \qquad 3.120$$

The solution of Equation 3.120 is as shown in Equation 3.121

$$\frac{\partial^2 w}{\partial R^2} = -\frac{1}{\beta^2}\frac{\partial^2 w}{\partial Q^2} \qquad 3.121$$

Let the orthogonal deflection be defined in terms of split deflection as shown in Equation 3.122

$$w = w_x . w_y \qquad 3.122$$

Also let a constant "one (1)" be defined as summation of three constants; n_1, n_2 and n_3 as expressed in Equation 3.123

$$1 = n_1 + n_2 + n_3 \qquad 3.123$$

Substituting Equations 3.122 and 3.123 into Equation 3.119 gives the expression of Equation 3.124

$$\int_0^1\int_0^1 \left\{w_y \frac{\partial^4 w_x}{\partial R^4} + 2\frac{m_2}{\beta^2}\frac{\partial^2 w_x}{\partial R^2}.\frac{\partial^2 w_y}{\partial Q^2} + w_x\frac{m_3}{\beta^4}.\frac{\partial^4 w_y}{\partial Q^4} - \frac{m_5 q a^4}{D_0}(n_1 + n_2 + n_3)\right\} dR\, dQ = 0 \qquad 3.124$$

Rearranging Equation 3.124 gives Equation 3.125

$$\int_0^1\int_0^1 \left\{w_y \frac{\partial^4 w_x}{\partial R^4} - \frac{m_5 q a^4}{D_0} n_1 + 2\frac{m_2}{\beta^2}\frac{\partial^2 w_x}{\partial R^2}.\frac{\partial^2 w_y}{\partial Q^2} - \frac{m_5 q a^4}{D_0} n_2 + w_x\frac{m_3}{\beta^4}.\frac{\partial^4 w_y}{\partial Q^4} - \frac{m_5 q a^4}{D_0} n_3\right\} dR\, dQ = 0$$

3.125a

That is:

$$\int_0^1\int_0^1 \left\{\left[w_y \frac{\partial^4 w_x}{\partial R^4} - \frac{m_5 q a^4}{D_0} n_1\right] + \left[2\frac{m_2}{\beta^2}\frac{\partial^2 w_x}{\partial R^2}.\frac{\partial^2 w_y}{\partial Q^2} - \frac{m_5 q a^4}{D_0} n_2\right] + \left[w_x\frac{m_3}{\beta^4}.\frac{\partial^4 w_y}{\partial Q^4} - \frac{m_5 q a^4}{D_0} n_3\right]\right\} dR\, dQ = 0 \qquad 3.125b$$

One of the possibilities of Equation 3.125 to be zero is for each of the square brackets to be zero as expressed in Equations 3.126, 3.127 and 3.128

$$\int_0^1\int_0^1 \left[w_y \frac{\partial^4 w_x}{\partial R^4} - \frac{m_5 q a^4}{D_0} n_1\right] dR\, dQ = 0 \qquad 3.126$$

$$\int_0^1\int_0^1 \left[2\frac{m_2}{\beta^2} \frac{\partial^2 w_x}{\partial R^2} . \frac{\partial^2 w_y}{\partial Q^2} - \frac{m_5 q a^4}{D_0} n_2\right] dR\, dQ = 0 \qquad 3.127$$

$$\int_0^1\int_0^1 \left[w_x \frac{m_3}{\beta^4} . \frac{\partial^4 w_y}{\partial Q^4} - \frac{m_5 q a^4}{D_0} n_3\right] dR\, dQ = 0 \qquad 3.128$$

Carrying out a closed domain integration of Equation 3.126 with respect to Q gives the expression of Equation 3.129

$$\int_0^1 \left(w_3 \frac{d^4 w_x}{dR^4} - \frac{m_5 q a^4}{D_0} n_1\right) dR = 0 \qquad 3.129$$

Carrying out a closed domain integration of Equation 3.128 with respect to R gives the expression of Equation 3.130

$$\int_0^1 \left(\frac{w_1 m_3}{\beta^4} \frac{d^4 w_y}{dQ^4} - \frac{m_5 q a^4}{D_0} n_3\right) dQ = 0 \qquad 3.130$$

Where w_1 and w_3 are as expressed in Equations 3.131 and 3.132

$$w_1 = \int_0^1 w_x \, dR \qquad 3.131$$

$$w_3 = \int_0^1 w_y \, dQ \qquad 3.132$$

w_1 and w_3 are all constant quantities.

For Equations 3.129 and 3.130 to be true, their integrands must be zero as shown in Equations 3.133 and 3.134

$$w_3 \frac{d^4 w_x}{dR^4} - \frac{m_5 q a^4}{D_0} n_1 = 0 \quad 3.133$$

$$\frac{w_1 m_3}{\beta^4} \frac{d^4 w_y}{dQ^4} - \frac{m_5 q a^4}{D_0} n_3 = 0 \quad 3.134$$

Equations 3.133 and 3.134 can be rearranged as expressed in Equations 3.135 and 3.136

$$\frac{d^4 w_x}{dR^4} = \frac{m_5 q a^4}{D_0} \left(\frac{n_1}{w_3} \right) \quad 3.135$$

$$\frac{d^4 w_y}{dQ^4} = \frac{m_5 q a^4}{D_0} \left(\frac{\beta^4 n_3}{w_1 m_3} \right) \quad 3.136$$

The ready solution to Equation 3.135 is as expressed in Equation 3.137

$$w_x = [1 \quad R \quad R^2 \quad R^3 \quad R^4] \begin{bmatrix} a_0 \\ a_1 \\ \left(\frac{a_2}{2}\right) \\ \left(\frac{a_3}{6}\right) \\ \frac{qa^4}{24D_{11}} \left(\frac{n_1}{w_3}\right) \end{bmatrix} = [h_x][A_{x1}] \quad 3.137$$

The ready solution to Equation 3.136 is as expressed in Equation 3.138

$$w_y = [1 \quad Q \quad Q^2 \quad Q^3 \quad Q^4] \begin{bmatrix} b_0 \\ b_1 \\ \left(\frac{b_2}{2}\right) \\ \left(\frac{b_3}{6}\right) \\ \frac{qa^4}{24D_{22}} \left(\frac{\beta^4 n_3}{w_1}\right) \end{bmatrix} = [h_y][A_{1y}] \quad 3.138$$

Substituting Equations 3.137 and 3.138 into Equation 3.122 gives the expression of Equation 3.139

$$w = [h_x][A_{x1}] \times [h_y][A_{1y}] = A_1 h \quad 3.139$$

Substituting Equation 3.139 into Equation 3.107 gives the expression of Equation 3.140a as shown

$$\emptyset_x = \frac{\mathrm{P_2}}{a}.\frac{\partial w}{\partial R} = \frac{\mathrm{P_2}}{a}.\frac{\partial \mathrm{A_1 h}}{\partial R} = \frac{\mathrm{P_2 A_1}}{a}.\frac{\partial \mathrm{h}}{\partial R}$$

That is:

$$\emptyset_x = \frac{\mathrm{A_2}}{a}.\frac{\partial \mathrm{h}}{\partial R} \qquad 3.140a$$

Where $\mathrm{A_2}$ is as expressed in Equation 3.140b

$$\mathrm{A_2} = \mathrm{P_2 A_1} \qquad 3.140b$$

Substituting Equation 3.139 into Equation 3.108 gives the expression of Equation 3.141a as shown

$$\emptyset_\mathrm{y} = \frac{\mathrm{P_3}}{a\beta}.\frac{\partial w}{\partial Q} = \frac{\mathrm{P_3}}{a\beta}.\frac{\partial \mathrm{A_1 h}}{\partial Q} = \frac{\mathrm{P_3 A_1}}{a\beta}.\frac{\partial \mathrm{h}}{\partial Q}$$

That is:

$$\emptyset_\mathrm{y} = \frac{\mathrm{A_3}}{a\beta}.\frac{\partial \mathrm{h}}{\partial Q} \qquad 3.141a$$

Where $\mathrm{A_3}$ is as expressed in Equation 3.141b

$$\mathrm{A_3} = \mathrm{P_3 A_1} \qquad 3.141b$$

Substituting Equations 3.139, 3.140a and 3.141a into Equation 3.91 gives the expression of Equation 3.142

$$\Pi = \frac{abD_0}{2a^4} . \int_0^1 \int_0^1 \left\{ \left\{ B_{11} . \left[A_1{}^2 - 2g_2 A_1 A_2 . + g_3 A_2{}^2 \right] \left(\frac{\partial^2 h}{\partial R^2} \right)^2 \right. \right.$$

$$+ \frac{B_{12}}{\beta^2} . \left[2A_1{}^2 \left(\frac{\partial^2 h}{\partial R \, \partial Q} \right)^2 - \frac{g_2 A_1 A_3}{\beta^2} \left(\frac{\partial^2 h}{\partial Q^2} \right)^2 - g_2 A_1 A_2 \beta^2 \left(\frac{\partial^2 h}{\partial R^2} \right)^2 \right.$$

$$\left. - g_2 A_1 A_2 . \left(\frac{\partial^2 h}{\partial R \, \partial Q} \right)^2 - g_2 A_1 A_3 . \left(\frac{\partial^2 h}{\partial R \, \partial Q} \right)^2 + 2g_3 A_2 A_3 . \left(\frac{\partial^2 h}{\partial R \, \partial Q} \right)^2 \right]$$

$$+ \frac{B_{13}}{\beta} . \left[4A_1{}^2 - 2g_2 (A_1 A_2 + A_1 A_3) - 4g_2 A_1 A_2 + 2g_3 \left(A_2{}^2 + A_2 A_3 \right) \right] \frac{\partial^2 h}{\partial R \partial Q} . \frac{\partial^2 h}{\partial R^2}$$

$$+ \frac{B_{22}}{\beta^4} . \left[A_1{}^2 - 2g_2 A_1 A_3 + g_3 A_3{}^2 \right] \left(\frac{\partial^2 h}{\partial Q^2} \right)^2$$

$$+ \frac{B_{23}}{\beta^3} . \left[4A_1{}^2 - 2g_2 (A_1 A_2 + A_1 A_3) - 4g_2 A_1 A_3 + 2g_3 \left(A_2 A_3 + A_3{}^2 \right) \right] \frac{\partial^2 h}{\partial R \partial Q} . \frac{\partial^2 h}{\partial Q^2}$$

$$+ \frac{B_{33}}{\beta^2} . \left[4A_1{}^2 - 2g_2 (A_1 A_2 + A_1 A_3) + g_3 \left(A_2{}^2 + 2A_2 A_3 + A_3{}^2 \right) \right] \left(\frac{\partial^2 h}{\partial R \, \partial Q} \right)^2$$

$$\left. \left. + B_{44} . \left(\frac{a}{t} \right)^2 . g_4 . A_2{}^2 \left(\frac{\partial h}{\partial R} \right)^2 + \frac{B_{55}}{\beta^2} . \left(\frac{a}{t} \right)^2 . g_4 A_3{}^2 \left(\frac{\partial h}{\partial Q} \right)^2 \right\} - 2A_1 \frac{qa^4}{D_0} h \right\} dR \, dQ \qquad 3.142$$

Equation 3.142 is written in a more symbolized form as shown in Equation 3.143

$$\Pi = \frac{abD_0}{2a^4} . \left\{ \left\{ B_{11} . \left[A_1{}^2 - 2g_2 A_1 A_2 . + g_3 A_2{}^2 \right] k_1 \right. \right.$$

$$+ \frac{B_{12}}{\beta^2} . \left[2A_1{}^2 k_2 - \frac{g_2 A_1 A_3}{\beta^2} k_3 - g_2 A_1 A_2 \beta^2 k_1 - g_2 A_1 A_2 . k_2 - g_2 A_1 A_3 . k_2 \right.$$

$$\left. + 2g_3 A_2 A_3 . k_2 \right]$$

$$+ \frac{B_{13}}{\beta} . \left[4A_1{}^2 - 2g_2 (A_1 A_2 + A_1 A_3) - 4g_2 A_1 A_2 + 2g_3 \left(A_2{}^2 + A_2 A_3 \right) \right] k_4$$

$$+ \frac{B_{22}}{\beta^4} . \left[A_1{}^2 - 2g_2 A_1 A_3 + g_3 A_3{}^2 \right] k_3$$

$$+ \frac{B_{23}}{\beta^3} . \left[4A_1{}^2 - 2g_2 (A_1 A_2 + A_1 A_3) - 4g_2 A_1 A_3 + 2g_3 \left(A_2 A_3 + A_3{}^2 \right) \right] k_5$$

$$+ \frac{B_{33}}{\beta^2} . \left[4A_1{}^2 - 2g_2 (A_1 A_2 + A_1 A_3) + g_3 \left(A_2{}^2 + 2A_2 A_3 + A_3{}^2 \right) \right] k_2$$

$$\left. \left. + B_{44} . \left(\frac{a}{t} \right)^2 . g_4 . A_2{}^2 k_6 + \frac{B_{55}}{\beta^2} . \left(\frac{a}{t} \right)^2 . g_4 A_3{}^2 k_7 \right\} - 2A_1 \frac{qa^4}{D_0} k_8 \right\} \qquad 3.143$$

To obtain the quasi equations of equilibrium of forces, Equation 3.143 must be differentiated with respect to A_1, A_2 and A_3 as expressed in Equation 3.144

$$\frac{d\prod}{dA_1} = \frac{d\prod}{dA_2} = \frac{d\prod}{dA_3} = 0 \qquad 3.144$$

Minimizing Equation 3.143 with respect to A_1 gives the expression of Equation 3.145

$$\frac{d\prod}{dA_1} = \frac{abD_0}{2a^4}.\Bigg\{\Big\{B_{11}.[2A_1 - 2g_2A_2]k_1 + \frac{B_{12}}{\beta^2}.\left[4A_1k_2 - \frac{g_2A_3}{\beta^2}k_3 - g_2A_2\beta^2k_1 - g_2A_2.k_2 - g_2A_3.k_2\right] + \frac{B_{13}}{\beta}.[8A_1 - 2g_2(A_2 + A_3) - 4g_2A_2]k_4 + \frac{B_{22}}{\beta^4}.[2A_1 - 2g_2A_3]k_3 + \frac{B_{23}}{\beta^3}.[8A_1 - 2g_2(A_2 + A_3) - 4g_2A_3]k_5 + \frac{B_{33}}{\beta^2}.[8A_1 - 2g_2(A_2 + A_3)]k_2\Big\} - 2\frac{qa^4}{D_0}k_8\Bigg\} = 0$$

That is:

$$\Big\{B_{11}.[A_1 - g_2A_2]k_1 + \frac{B_{12}}{2\beta^2}.\left[4A_1k_2 - \frac{g_2A_3}{\beta^2}k_3 - g_2A_2\beta^2k_1 - g_2A_2.k_2 - g_2A_3.k_2\right] + \frac{B_{13}}{\beta}.[4A_1 - g_2(A_2 + A_3) - 2g_2A_2]k_4 + \frac{B_{22}}{\beta^4}.[A_1 - g_2A_3]k_3 + \frac{B_{23}}{\beta^3}.[4A_1 - g_2(A_2 + A_3) - 2g_2A_3]k_5 + \frac{B_{33}}{\beta^2}.[4A_1 - g_2(A_2 + A_3)]k_2\Big\} - \frac{qa^4}{D_0}k_8 = 0 \qquad 3.145$$

Minimizing Equation 3.143 with respect to A_2 gives the expression of Equation 3.146

$$\frac{d\prod}{dA_2} = \frac{ab\ _0}{2a^4}.\Big\{B_{11}.[-2g_2A_1. + 2g_3A_2]k_1 + \frac{B_{12}}{\beta^2}.[-g_2A_1\beta^2k_1 - g_2A_1.k_2 + 2g_3A_3.k_2] + \frac{B_{13}}{\beta}.[-2g_2(A_1) - 4g_2A_1 + 2g_3(2A_2 + A_3)]k_4 + \frac{B_{23}}{\beta^3}.[-2g_2(A_1) + 2g_3(A_3)]k_5 + \frac{B_{33}}{\beta^2}.[-2g_2(A_1) + g_3(2A_2 + 2A_3)]k_2 + 2B_{44}.\left(\frac{a}{t}\right)^2.g_4.A_2k_6\Big\} = 0 \qquad 3.146a$$

That is:

$$B_{11}.[-g_2A_1.+g_3A_2]k_1+\frac{B_{12}}{2\beta^2}.[-g_2A_1\beta^2k_1-g_2A_1.k_2+2g_3A_3.k_2]$$
$$+\frac{B_{13}}{\beta}.[-g_2(A_1)-2g_2A_1+g_3(2A_2+A_3)]k_4+\frac{B_{23}}{\beta^3}.[-g_2(A_1)+g_3(A_3)]k_5$$
$$+\frac{B_{33}}{\beta^2}.[-g_2(A_1)+g_3(A_2+A_3)]k_2+B_{44}.\left(\frac{a}{t}\right)^2.g_4.A_2k_6=0 \qquad 3.146b$$

Minimizing Equation 3.143 with respect to A_3 gives the expression of Equation 3.147

$$\frac{d\Pi}{dA_3}=\frac{ab\ \ _0}{2a^4}.\left\{\frac{B_{12}}{\beta^2}.\left[-\frac{g_2A_1}{\beta^2}k_3-g_2A_1.k_2+2g_3A_2.k_2\right]+\frac{B_{13}}{\beta}.[-2g_2(A_1)+2g_3(A_2)]k_4+\right.$$
$$\frac{B_{22}}{\beta^4}.[-2g_2A_1+2g_3A_3]k_3+\frac{B_{23}}{\beta^3}.[-2g_2(A_1)-4g_2A_1+2g_3(A_2+2A_3)]k_5+$$
$$\left.\frac{B_{33}}{\beta^2}.[-2g_2(A_1)+g_3(2A_2+2A_3)]k_2+2\frac{B_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2.g_4A_3k_7\right\}=0 \qquad 3.147a$$

That is:

$$\frac{B_{12}}{2\beta^2}.\left[-\frac{g_2A_1}{\beta^2}k_3-g_2A_1.k_2+2g_3A_2.k_2\right]+\frac{B_{13}}{\beta}.[-g_2(A_1)+g_3(A_2)]k_4$$
$$+\frac{B_{22}}{\beta^4}.[-g_2A_1+g_3A_3]k_3+\frac{B_{23}}{\beta^3}.[-g_2(A_1)-2g_2A_1+g_3(A_2+2A_3)]k_5$$
$$+\frac{B_{33}}{\beta^2}.[-g_2(A_1)+g_3(A_2+A_3)]k_2+\frac{B_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2.g_4A_3k_7=0 \qquad 3.147b$$

Rearranging Equation 3.146 gives Equation 3.148

$$\left[g_3B_{11}k_1+\frac{B_{33}}{\beta^2}g_3k_2+2\frac{B_{13}}{\beta}g_3k_4+B_{44}.\left(\frac{a}{t}\right)^2.g_4.k_6\right]A_2$$
$$+\left[(B_{12}+B_{33})\frac{g_3}{\beta^2}k_2+\frac{B_{13}}{\beta}g_3k_4+\frac{B_{23}}{\beta^3}g_3k_5\right]A_3$$
$$=\left[(B_{11}+0.5B_{12})g_2k_1+(0.5B_{12}+B_{33})\frac{g_2}{\beta^2}k_2+3\frac{B_{13}}{\beta}g_2k_4\right.$$
$$\left.+\frac{B_{23}}{\beta^3}g_2k_5\right]A_1 \qquad 3.148$$

Rearranging Equation 3.147 gives Equation 3.149

$$\left[(B_{12} + B_{33})\frac{g_3}{\beta^2}.k_2 + \frac{B_{13}}{\beta}g_3k_4 + \frac{B_{23}}{\beta^3}g_3k_5\right]A_2$$

$$+\left[\frac{B_{22}}{\beta^4}g_3k_3 + 2\frac{B_{23}}{\beta^3}g_3k_5 + \frac{B_{33}}{\beta^2}g_3k_2 + \frac{B_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2.g_4k_7\right]A_3$$

$$= \left[(0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + (0.5B_{12} + B_{22})\frac{g_2}{\beta^4}k_3 + \frac{B_{13}}{\beta}g_2k_4\right.$$

$$\left. + 3\frac{B_{23}}{\beta^3}g_2k_5\right]A_1 \qquad 3.149$$

Note that: $k_1, k_2, k_3, k_4, k_5, k_6, k_7$ and k_8 were substituted in Equation 3.142 as given in Equation 3.150 to 3.157

$$k_1 = \int_0^1\int_0^1\left(\frac{d^2h}{dR^2}\right)^2 dR\,dQ \qquad 3.150$$

$$k_2 = \int_0^1\int_0^1\left(\frac{d^2h}{dRdQ}\right)^2 dR\,dQ \qquad 3.151$$

$$k_3 = \int_0^1\int_0^1\left(\frac{d^2h}{dQ^2}\right)^2 dR\,dQ \qquad 3.152$$

$$k_4 = \int_0^1\int_0^1\left(\frac{d^2h}{dR^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\,dQ \qquad 3.153$$

$$k_5 = \int_0^1\int_0^1\left(\frac{d^2h}{dQ^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\,dQ \qquad 3.154$$

$$k_6 = \int_0^1\int_0^1\left(\frac{dh}{dR}\right)^2 dR\,dQ \qquad 3.155$$

$$k_7 = \int_0^1\int_0^1\left(\frac{dh}{dQ}\right)^2 dR\,dQ \qquad 3.156$$

$$k_8 = \int_0^1\int_0^1 h\,dR\,dQ \qquad 3.157$$

Equations 3.118 and 3.119 are solved simultaneously to obtain Equations 3.158 and 3.159

$$A_2 = P_2.A_1 \qquad 3.158)$$

$$A_3 = P_3.A_1 \qquad 3.159$$

Where P_2 and P_3 are defined as shown in Equations 3.160 and 3.161

$$P_2 = \frac{(L_{12}.L_{23} - L_{13}.L_{22})}{\left(L_{12}{}^2 - L_{11}L_{22}\right)} \qquad 3.160$$

$$P_3 = \frac{(L_{12}.L_{13} - L_{11}L_{23})}{\left(L_{12}{}^2 - L_{11}L_{22}\right)} \qquad 3.161$$

Also L_{11}, L_{12}, L_{13}, L_{21}, L_{22}, L_{23}, L_{31}, L_{32} and L_{33} are expressed as shown in Equations 3.162 to 3.167

$$L_{11} = g_3 B_{11} k_1 + \frac{B_{33}}{\beta^2} g_3 k_2 + 2\frac{B_{13}}{\beta} g_3 k_4 + B_{44}.\left(\frac{a}{t}\right)^2 . g_4 . k_6 \qquad 3.162$$

$$L_{12} = (B_{12} + B_{33})\frac{g_3}{\beta^2} k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 \qquad 3.163$$

$$L_{13} = (B_{11} + 0.5B_{12}) g_2 k_1 + (0.5B_{12} + B_{33})\frac{g_2}{\beta^2} k_2 + 3\frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 \qquad 3.164$$

$$L_{21} = (B_{12} + B_{33})\frac{g_3}{\beta^2}. k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 \qquad 3.165$$

$$L_{22} = \frac{B_{22}}{\beta^4} g_3 k_3 + 2\frac{B_{23}}{\beta^3} g_3 k_5 + \frac{B_{33}}{\beta^2} g_3 k_2 + \frac{B_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2 . g_4 k_7 \qquad 3.166$$

$$L_{23} = (0.5B_{12} + B_{33})\frac{g_2}{\beta^2} k_2 + (0.5B_{12} + B_{22})\frac{g_2}{\beta^4} k_3 + \frac{B_{13}}{\beta} g_2 k_4 + 3\frac{B_{23}}{\beta^3} g_2 k_5 \qquad 3.167$$

Substituting Equations 3.160 and 3.161 into Equation 3.145 and rearranging gives Equation 3.168

$$[B_{11} - B_{11} g_2 P_2 - 0.5B_{12} g_2 P_2] k_1 + \frac{1}{\beta^2}[(4 - g_2 P_2 - g_2 P_3) B_{33} + 0.5(4 - g_2 P_2 - g_2 P_3) B_{12}] k_2 + \frac{1}{\beta^4}[B_{22} - B_{22} g_2 P_3 - 0.5B_{12} g_2 P_3] k_3 + \frac{B_{13}}{\beta}[4 - g_2(P_2 + P_3) - 2g_2 H_2] k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2(P_2 + P_3) - 2g_2 P_3] k_5 = \frac{q a^4}{A_1 D_0} k_8 \qquad 3.168a$$

That is:

$$[B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 + \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 + \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 + \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 = \frac{qa^4}{A_1D_0}k_8 \quad 3.168b$$

Simplifying Equation 3.168 gives the expression of Equation 3.169

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 3.169$$

Where k_T is as expressed in Equation 3.170

$$k_T = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 + \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 + \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 + \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 \quad 3.170$$

Substituting Equation 3.158 into Equation 3.140a gives the expression of Equation 3.171

$$\emptyset_x = \frac{P_2.A_1}{a}.\frac{\partial h}{\partial R} \quad 3.171$$

Substituting Equation 3.159 into Equation 3.141a gives the expression of Equation 3.172

$$\emptyset_y = \frac{P_3.A_1}{a\beta}.\frac{\partial h}{\partial Q} \quad 3.172$$

Equations 3.169, 3.171 and 3.172 are the polynomial exact displacement functions.

Ibearugbulem et.al. (2013) integrated the general governing equation of rectangular plate directly and obtained a general solution in non-dimensional coordinates as expressed in Equation 3.173

$$W = (\alpha_0 + \alpha_1 R + \alpha_2 R^2 + \alpha_3 R^3 + \alpha_4 R^4)(\beta_0 + \beta_1 Q + \beta_2 Q^2 + \beta_3 Q^3 + \beta_4 Q^4) \quad 3.173$$

Equation 3.173 is a general orthogonal polynomial deflection equation for a rectangular plate. From equation 3.173, a more peculiar orthogonal polynomial displacement equation can be determined for the twelve plate boundary conditions considered in this work and this can be achieved by satisfying both the kinematic and force boundary conditions of the plate in the general orthogonal polynomial deflection equation as illustrated here.

3.3.1.1 Exact polynomial displacement functions for SSSS rectangular plate

The boundary condition for these plate are as follows;

The four kinematic boundary conditions are:

i. Deflection is zero when R is Zero [w(R = 0) = 0]
ii. Deflection is zero when R is one [w(R = 1) = 0]
iii. Deflection is zero when Q is Zero [w(Q = 0) = 0]
iv. Deflection is zero when Q is one [w(Q = 0) = 0]

The four force boundary conditions are:

i. Moment is zero when R is Zero [M(R = 0) = 0]
ii. Moment is zero when R is one [M(R = 1) = 0]
iii. Moment is zero when Q is Zero [M(Q = 0) = 0]
iv. Moment is zero when Q is one [M(R = 1) = 0]

OR alternatively;

$$W(R = 0) = \frac{d^2 w_{(R=0)}}{dR^2} = 0$$

$$W(R = 1) = \frac{d^2 w_{(R=1)}}{dR^2} = 0$$

$$W(Q = 0) = \frac{d^2 w_{(Q=0)}}{dQ^2} = 0$$

$$W(Q = 1) = \frac{d^2 w_{(Q=1)}}{dQ^2} = 0$$

From first kinematic boundary condition, Equation 3.173 gives:

$0 = (\alpha_0 + \alpha_1 \text{ x } 0 + \alpha_2 \text{ x } 0 + \alpha_3 \text{ x } 0 + \alpha_4 \text{ x } 0)$ implies that $\alpha_0 = 0$

From third kinematic boundary condition Equation 3.173 gives:

$0 = (\beta_0 + \beta_1 \text{ x } 0 + \beta_2 \text{ x } 0 + \beta_3 \text{ x } 0 + \beta_4 \text{ x } 0)$ implies that $\beta_0 = 0$

From first force boundary condition Equation 3.173 gives:

$0 = (2\alpha_2 + 6\alpha_3 \text{ x } 0 + 12\alpha_4 \text{ x } 0)$ implies that $\alpha_2 = 0$

From third force boundary condition Equation 3.173 gives:

$0 = (2\beta_2 + 6\beta_3 \text{ x } 0 + 12\beta_4 \text{ x } 0)$ implies that $\beta_2 = 0$

From second kinematic boundary condition Equation 3.173 gives the expression of Equation 3.173a

$$0 = (\alpha_1 \text{ x } 1 + \alpha_3 \text{ x } 1 + \alpha_4 \text{ x } 1) \qquad 3.173a$$

From second force boundary condition Equation 3.173 gives the expression of Equation 3.173b

$$0 = (2\alpha_2 + 6\alpha_3 \text{ x } 1 + 12\alpha_4 \text{ x } 1) \qquad 3.173b$$

Solving equations 3.173a and 3.173b simultaneously gives $\alpha_1 = \alpha_4$ and $\alpha_3 = -2\alpha_4$

From fourth kinematic boundary condition Equation 3.173 gives the expression of Equation 3.173c

$$0 = (\beta_1 \text{ x } 1 + \beta_3 \text{ x } 1 + \beta_4 \text{ x } 1) \qquad 3.173c$$

From fourth force boundary condition Equation 3.173 gives the expression of Equation 3.173d

$$0 = (2\beta_2 + 6\beta_3 \text{ x } 1 + 12\beta_4 \text{ x } 1) \qquad 3.173d$$

Solving Equations 3.173c and 3.173d simultaneously gives $\beta_1 = \beta_4$ and $\beta_3 = -2\beta_4$

Substituting these coefficients into Equation 3.173 gives Equation 3.174a

$$w = \alpha_4 . \beta_4 \, (R - 2R^3 + R^4)\,(Q - 2Q^3 + Q^4)$$

$$w = A_1 .(R - 2R^3 + R^4)\,(Q - 2Q^3 + Q^4) \qquad 3.174a$$

Where $A_1 = \alpha_4 . \beta_4$

From Equation 3.174a, the shape profile for SSSS plate can be expressed as shown in Equation 3.174b

$$h = (R - 2R^3 + R^4)\,(Q - 2Q^3 + Q^4) \qquad 3.174b$$

Equation 3.174b was differentiated appropriately with respect to (R) and (Q) to obtain the required peculiar exact displacement functions for SSSS rectangular plates as shown in Equations 3.174c, 3.174d, 3.174e, 3.174f, 3.174g, 3.174h and 3.174i.

$$w = A_1 h = A_1(R\text{-}2R^3\text{+}R^4)(Q\text{-}2Q^3\text{+}Q^4) \qquad 3.174c$$

$\emptyset_x = A_2.\frac{dh}{dR} = A_2(1\text{-}6R^2\text{+}4R^3)(Q\text{-}2Q^3\text{+}Q^4)$ 3.174d

$\emptyset_y = A_3.\frac{dh}{dQ} = A_3(R\text{-}2R^3\text{+}R^4)\ (1\text{-}6Q^2\text{+}4Q^3)$ 3.174e

$\emptyset_x{}^{I} = A_2.\frac{d^2h}{dR^2} = A_2(R^2\text{-}R)(Q\text{-}2Q^3\text{+}Q^4).12$ 3.174f

$\emptyset_y{}^{I} = A_3.\frac{d^2h}{dQ^2} = A_3(R\text{-}2R^3\text{+}R^4)(Q^2\text{-}Q).12$ 3.174g

$W_{xy}{}^{II} = A_1.\frac{d^2w}{dRdQ} = A_1(1\text{-}6R^2\text{+}4R^3)(1\text{-}6Q^2\text{+}4Q^3)$ 3.174h

Where $A_2 = \frac{P_2.A_1}{\alpha}$ and $A_3 = \frac{P_3.A_1}{\alpha\beta}$ 3.174i

3.3.1.2 Exact polynomial displacement functions for CCCC rectangular plate

The boundary condition for this plate are as follows;

$W(R = 0) = \frac{dw_{(R=0)}}{dR} = 0$

$W(R = 1) = \frac{dw_{(R=1)}}{dR} = 0$

$W(Q = 0) = \frac{dw_{(Q=0)}}{dQ} = 0$

$W(Q = 1) = \frac{dw_{(Q=1)}}{dQ} = 0$

Applying these boundary conditions to Equation 3.173 and solving gives

$\alpha_0 = 0;\ \alpha_1 = 0;\ \alpha_2 = \alpha_4;\ \alpha_3 = -2\alpha_4$ and $\beta_0 = 0;\ \beta_1 = 0;\ \beta_2 = \beta_4;\ \beta_3 = -2\beta_4$

Substituting these constants back into Equation 3.173 gives the expression of Equation 3.175a

$w = \alpha_4.\ \beta_4\ (R^2\text{-}\ 2R^3 + R^4)\ (Q^2\ \text{-}\ 2Q^3 + Q^4)$

$w = A_1(R^2 - 2R^3 + R^4)\ (Q^2 - 2Q^3 + Q^4)$ 3.175a

Where $A_1 = \alpha_4.\ \beta_4$

The shape profile for CCCC plate is given as shown in Equation 3.175b

$h = (R^2 - 2R^3 + R^4)\ (Q^2 - 2Q^3 + Q^4)$ 3.175b

Equation 3.175b was differentiated appropriately with respect to (R) and (Q) to obtain the required peculiar exact displacement functions for CCCC rectangular plates as shown in Equations 3.175c, 3.175d, 3.175e, 3.175f, 3.175g, 3.175h and 3.175i

$$w = A_1 h = A_1(R^2-2R^3+R^4)(Q^2-2Q^3+Q^4) \quad 3.175c$$

$$\emptyset_x = A_2.\frac{dh}{dR} = A_2(2R-6R^2+4R^3)(Q^2-2Q^3+Q^4) \quad 3.175d$$

$$\emptyset_y = A_3.\frac{dh}{dQ} = A_3(R^2-2R^3+R^4)(2Q-6Q^2+4Q^3) \quad 3.175e$$

$$\emptyset_x{}^{I} = A_2.\frac{d^2h}{dR^2} = A_2(2-12R+12R^2)(Q^2-2Q^3+Q^4) \quad 3.175f$$

$$\emptyset_y{}^{I} = A_3.\frac{d^2h}{dQ^2} = A_3(R^2-2R^3+R^4)(2-12Q+12Q^2) \quad 3.175g$$

$$W_{xy}{}^{II} = A_1.\frac{d^2w}{dRdQ} = A_1(2R-6R^2+4R^3)(2Q-6Q^2+4Q^3) \quad 3.175h$$

$$\text{Where } A_2 = \frac{P_2.A_1}{\alpha} \text{ and } A_3 = \frac{P_3.A_1}{\alpha\beta} \quad 3.175i$$

3.3.1.3 Exact polynomial displacement functions for CSSS rectangular plate

The boundary condition for this plate are as follows;

$$W(R = 0) = \frac{d^2 w_{(R=0)}}{dR^2} = 0$$

$$W(R = 1) = \frac{d^2 w_{(R=1)}}{dR^2} = 0$$

$$W(Q = 0) = \frac{d w_{(Q=0)}}{dQ} = 0$$

$$W(Q = 1) = \frac{d^2 w_{(Q=1)}}{dQ^2} = 0$$

Applying these boundary conditions to Equation 3.173 and solving gives

$\alpha_0 = 0$; $\alpha_1 = \alpha_4$; $\alpha_2 = 0$; $\alpha_3 = -2\alpha_4$ and $\beta_0 = 0$; $\beta_1 = 0$; $\beta_2 = 1.5\beta_4$; $\beta_3 = -2.5\beta_4$

Substituting these constants back into Equation 3.173 gives the expression of Equation 3.176a

$$w = \alpha_4 . \beta_4 \, (R- 2R^3 + R^4)\,(1.5Q^2 - 2.5Q^3 + Q^4)$$

$$w = A_1(R - 2R^3 + R^4)\,(1.5Q^2 - 2.5Q^3 + Q^4) \quad 3.176a$$

Where $A_1 = \alpha_4 . \beta_4$

The shape profile for CSSS plate is given as shown in Equation 3.176b

$$h = (R - 2R^3 + R^4)(1.5Q^2 - 2.5Q^3 + Q^4) \qquad 3.176b$$

Equation 3.176b was differentiated appropriately with respect to (R) and (Q) to obtain the required peculiar exact displacement functions for CSSS rectangular plates as shown in Equations 3.176c, 3.176d, 3.176e, 3.176f, 3.176g, 3.176h and 3.176i

$$w = A_1 h = A_1(R-2R^3+R^4)(1.5Q^2-2.5Q^3+Q^4) \qquad 3.176c$$

$$\emptyset_x = A_2.\frac{dh}{dR} = A_2(1-6R^2+4R^3)(1.5Q^2-2.5Q^3+Q^4) \qquad 3.176d$$

$$\emptyset_y = A_3.\frac{dh}{dQ} = A_3(R-2R^3+R^4)(3Q-7.5Q^2+4Q^3) \qquad 3.176e$$

$$\emptyset_x{}^{I} = A_2.\frac{d^2h}{dR^2} = A_2 12(R^2 - R)(1.5Q^2 - 2.5Q^3 + Q^4) \qquad 3.176f$$

$$\emptyset_y{}^{I} = A_3.\frac{d^2h}{dQ^2} = A_3(R-2R^3+R^4)(1-5Q+4Q^2) \qquad 3.176g$$

$$W_{xy}{}^{II} = A_1.\frac{d^2w}{dRdQ} = A_1(1-6R^2+4R^3)(3Q-7.5Q^2+4Q^3) \qquad 3.176h$$

Where $A_2 = \frac{P_2.A_1}{a}$ and $A_3 = \frac{P_3.A_1}{a\beta}$ 3.176i

3.3.1.4 Exact polynomial displacement function for CCSS rectangular plate

The boundary condition for this plate are as follows;

$$W(R = 0) = \frac{dw_{(R=0)}}{dR} = 0$$

$$W(R = 1) = \frac{d^2w_{(R=1)}}{dR^2} = 0$$

$$W(Q = 0) = \frac{dw_{(Q=0)}}{dQ} = 0$$

$$W(Q = 1) = \frac{d^2w_{(Q=1)}}{dQ^2} = 0$$

Applying these boundary conditions to Equation 3.173 and solving gives

$\alpha_0 = 0$; $\alpha_1 = 0$; $\alpha_2 = 1.5\alpha_4$; $\alpha_3 = -2.5\alpha_4$ and $\beta_0 = 0$; $\beta_1 = 0$; $\beta_2 = 1.5\beta_4$; $\beta_3 = -2.5\beta_4$

Substituting these constants back into Equation 3.173 gives the expression of Equation 3.177a

$$w = \alpha_4 . \beta_4 (1.5R^2 - 2.5R^3 + R^4)(1.5Q^2 - 2.5Q^3 + Q^4)$$

$$w = A_1(1.5R^2 - 2.5R^3 + R^4)(1.5Q^2 - 2.5Q^3 + Q^4) \qquad 3.177a$$

Where $A_1 = \alpha_4 . \beta_4$

The shape profile for CCSS plate is given as shown in Equation 3.177b

$$h = (1.5R^2 - 2.5R^3 + R^4)(1.5Q^2 - 2.5Q^3 + Q^4) \qquad 3.177b$$

Equation 3.177b was differentiated appropriately with respect to (R) and (Q) to obtain the required peculiar exact displacement functions for CCSS rectangular plates as shown in Equations 3.177c, 3.177d, 3.177e, 3.177f, 3.177g, 3.177h and 3.177i

$$w = A_1 h = A_1(1.5R^2 - 2.5R^3 + R^4)(1.5Q^2 - 2.5Q^3 + Q^4) \qquad 3.177c$$

$$\emptyset_x = A_2 . \frac{dh}{dR} = A_2(3R - 7.5R^2 + 4R^3)(1.5Q^2 - 2.5Q^3 + Q^4) \qquad 3.177d$$

$$\emptyset_y = A_3 . \frac{dh}{dQ} = A_3(1.5R^2 - 2.5R^3 + R^4)(3Q - 7.5Q^2 + 4Q^3) \qquad 3.177e$$

$$\emptyset_x^{I} = A_2 . \frac{d^2h}{dR^2} = A_2(3 - 15R + 12R^2)(1.5Q^2 - 2.5Q^3 + Q^4) \qquad 3.177f$$

$$\emptyset_y^{I} = A_3 . \frac{d^2h}{dQ^2} = A_3(1.5R^2 - 2.5R^3 + R^4)(3 - 15Q + 12Q^2) \qquad 3.177g$$

$$W_{xy}^{II} = A_1 . \frac{d^2w}{dRdQ} = A_1(3R - 7.5R^2 + 4R^3)(3Q - 7.5Q^2 + 4Q^3) \qquad 3.177h$$

Where $A_2 = \frac{P_2 . A_1}{a}$ and $A_3 = \frac{P_3 . A_1}{a\beta}$ 3.177i

3.3.1.5 Exact polynomial displacement function for CSCS rectangular plate

The boundary condition for this plate are as follows;

$$W(R = 0) = \frac{d^2 w_{(R=0)}}{dR^2} = 0$$

$W(R = 1) = \frac{d^2 w_{(R=1)}}{dR^2} = 0$

$W(Q = 0) = \frac{dw_{(Q=0)}}{dQ} = 0$

$W(Q = 1) = \frac{dw_{(Q=1)}}{dQ} = 0$

Applying these boundary conditions to Equation 3.173 and solving gives

$\alpha_0 = 0; \alpha_1 = \alpha_4; \alpha_2 = 0; \alpha_3 = -2\alpha_4$ and $\beta_0 = 0; \beta_1 = 0; \beta_2 = \beta_4; \beta_3 = -2\beta_4$

Substituting these constants back into Equation 3.173 gives the expression of Equation 3.178a

$$w = \alpha_4.\beta_4 (R - 2R^3 + R^4)(Q^2 - 2Q^3 + Q^4)$$

$$w = A_1(R - 2R^3 + R^4)(Q^2 - 2Q^3 + Q^4) \quad 3.178a$$

Where $A_1 = \alpha_4.\beta_4$

The shape profile for CSCS plate is given as shown in Equation 3.178b

$$h = (R - 2R^3 + R^4)(Q^2 - 2Q^3 + Q^4) \quad 3.178b$$

Equation 3.178b was differentiated appropriately with respect to (R) and (Q) to obtain the required peculiar exact displacement functions for CSCS rectangular plates as shown in Equations 3.178c, 3.178d, 3.178e, 3.178f, 3.178g, 3.178h and 3.178i

$$w = A_1 h = A_1(R-2R^3+R^4)(Q^2-2Q^3+Q^4) \quad 3.178c$$

$$\emptyset_x = A_2.\frac{dh}{dR} = A_2(1-6R^2+4R^3)(Q^2-2Q^3+Q^4) \quad 3.178d$$

$$\emptyset_y = A_3.\frac{dh}{dQ} = A_3(R-2R^3+R^4)(Q-6Q^2+4Q^3) \quad 3.178e$$

$$\emptyset_x^I = A_2.\frac{d^2h}{dR^2} = A_2 12(R^2 - R)(Q^2 - 2Q^3 + Q^4) \quad 3.178f$$

$$\emptyset_y^I = A_3.\frac{d^2h}{dQ^2} = A_3(R-2R^3+R^4)(2-12Q+12Q^2) \quad 3.178g$$

$$W_{xy}^{II} = A_1.\frac{d^2w}{dRdQ} = A_1(1-6R^2+4R^3)(2Q-6Q^2+4Q^3) \quad 3.178h$$

Where $A_2 = \frac{P_2.A_1}{a}$ and $A_3 = \frac{P_3.A_1}{a\beta}$ 3.178i

3.3.1.6 Exact polynomial displacement function for CCCS rectangular plate

The boundary condition for this plate are as follows;

$$W(R = 0) = \frac{dw_{(R=0)}}{dR^2} = 0$$

$$W(R = 1) = \frac{d^2w_{(R=1)}}{dR^2} = 0$$

$$W(Q = 0) = \frac{dw_{(Q=0)}}{dQ} = 0$$

$$W(Q = 1) = \frac{dw_{(Q=1)}}{dQ} = 0$$

Applying these boundary conditions to Equation 3.173 and solving gives

$$\alpha_0 = 0;\ \alpha_1 = 0;\ \alpha_2 = 1.5\alpha_4;\ \ \alpha_3 = -2.5\alpha_4 \text{ and } \beta_0 = 0;\ \beta_1 = 0;\ \beta_2 = \beta_4;\ \ \beta_3 = -2\beta_4$$

Substituting these constants back into Equation 3.173 gives the expression of Equation 3.179a

$$w = \alpha_4 . \beta_4\ (1.5R^2 - 2.5R^3 + R^4)\ (Q^2 - 2Q^3 + Q^4)$$

$$w = A_1(1.5R^2 - 2.5R^3 + R^4)\ (Q^2 - 2Q^3 + Q^4) \qquad 3.179a$$

Where $A_1 = \alpha_4 . \beta_4$

The shape profile for CCCS plate is given as shown in Equation 3.179b

$$h = (1.5R^2 - 2.5R^3 + R^4)\ (Q^2 - 2Q^3 + Q^4) \qquad 3.179b$$

Equation 3.179b was differentiated appropriately with respect to (R) and (Q) to obtain the required peculiar exact displacement functions for CCCS rectangular plates as shown in Equations 3.179c, 3.179d, 3.179e, 3.179f, 3.179g, 3.179h and 3.179i

$$w = A_1h = A_1(1.5R^2\text{-}2.5R^3\text{+}R^4)(Q^2\text{-}2Q^3\text{+}Q^4) \qquad 3.179c$$

$$\emptyset_x = A_2.\frac{dh}{dR} = A_2(3R\text{-}7.5R^2\text{+}4R^3)(Q^2\text{-}2Q^3\text{+}Q^4) \qquad 3.179d$$

$$\emptyset_y = A_3.\frac{dh}{dQ} = A_3(1.5R^2\text{-}2.5R^3\text{+}R^4)(2Q\text{-}6Q^2\text{+}4Q^3) \qquad 3.179e$$

$$\emptyset_x{}^{I} = A_2.\frac{d^2h}{dR^2} = A_2(3 - 15R + 12R^2)(Q^2 - 2Q^3 + Q^4) \qquad 3.179f$$

$\emptyset_y{}^{I} = A_3.\frac{d^2h}{dQ^2} = A_3(1.5R^2\text{-}2.5R^3\text{+}R^4)(2 - 12Q + 12Q^3)$ 3.179g

$W_{xy}{}^{II} = A_1.\frac{d^2w}{dRdQ} = A_1(3R\text{-}7.5R^2\text{+}4R^3)(2Q\text{-}6Q^2\text{+}4Q^3)$ 3.179h

Where $A_2 = \frac{P_2.A_1}{a}$ and $A_3 = \frac{P_3.A_1}{a\beta}$ 3.179i

3.3.1.7 Exact polynomial displacement function for SSFS rectangular plate

If one of the four edges of the plate is free of support, there is need for some modification to the general process. Hence the modifications are contained in the moments of the plates, thus the general orthogonal polynomial deflection equation for the rectangular plate is modified by Ibearugbulem , (2016) as shown in Equation 3.180

$$w = (\alpha_0 + \alpha_1 R + \alpha_2 R^2 + \alpha_3 R^3 + \alpha_4 R^4)\,(\beta_0 + \beta_1 Q + \beta_2 Q^2 + \beta_3 Q^3 + \beta_4 Q^4 + \beta_5 Q^5) \qquad 3.180$$

The boundary condition for this plate are as follows;

$W(R = 0) = \frac{d^2 w_{(R=0)}}{dR^2} = 0$

$W(R = 1) = \frac{d^2 w_{(R=1)}}{dR^2} = 0$

$W(Q = 0) = \frac{d^2 w_{(Q=0)}}{dQ^2} = 0$

$\frac{d^2 w_{(Q=1)}}{dQ^2} = \frac{d^3 w_{(Q=1)}}{dQ^3} = 0$

$\frac{dw_{(Q=1)}}{dQ} = \frac{2}{3\beta_5}$ (See Ibearugbulem, 2016, for details)

Applying these boundary conditions to Equation 3.180 and solving gives:

$\alpha_0 = 0; \alpha_1 = \alpha_4; \alpha_2 = 0;\ \alpha_3 = -2\alpha_4$ and $\beta_0 = 0; \beta_1 = \frac{7}{3}\beta_5; \beta_2 = 0; \beta_3 = -\frac{10}{3}\beta_5, \beta_4 = \frac{10}{3}\beta_5.$

Substituting these constants back into equation 3.180 gives the expression of Equation 3.181a

$w = \alpha_4.\beta_4\ (R - 2R^3 + R^4)\ (\frac{7}{3}Q - \frac{10}{3}Q^3 + \frac{10}{3}Q^4 - Q^5)$

$w = A_1(R - 2R^3 + R^4)\ (\frac{7}{3}Q - \frac{10}{3}Q^3 + \frac{10}{3}Q^4 - Q^5)$ 3.181a

Where $A_1 = \alpha_4.\beta_4$

The shape profile for SSFS plate is given as in Equation 3.181b

$$h = (R - 2R^3 + R^4)\left(\frac{7}{3}Q - \frac{10}{3}Q^3 + \frac{10}{3}Q^4 - Q^5\right) \qquad 3.181b$$

Equation 3.181b was differentiated appropriately with respect to (R) and (Q) to obtain the required peculiar exact displacement functions for SSFS rectangular plates as shown in Equations 3.181c, 3.181d, 3.181e, 3.181f, 3.181g, 3.181h and 3.181i

$$w = A_1 h = A_1(R-2R^3+R^4)\left(\left(\frac{7}{3}Q - \frac{10}{3}Q^3 + \frac{10}{3}Q^4 - Q^5\right) \qquad 3.181c$$

$$\emptyset_x = A_2.\frac{dh}{dR} = A_2(1-6R^2+4R^3)\left(\frac{7}{3}Q - \frac{10}{3}Q^3 + \frac{10}{3}Q^4 - Q^5\right) \qquad 3.181d$$

$$\emptyset_y = A_3.\frac{dh}{dQ} = A_3(R-2R^3+R^4)\left(\frac{7}{3} - 10Q^2 + \frac{40}{3}Q^3 - 5Q^4\right) \qquad 3.181e$$

$$\emptyset_x{}^{I} = A_2.\frac{d^2h}{dR^2} = A_2 12(R^2 - R)\left(\frac{7}{3}Q - \frac{10}{3}Q^3 + \frac{10}{3}Q^4 - Q^5\right) \qquad 3.181f$$

$$\emptyset_y{}^{I} = A_3.\frac{d^2h}{dQ^2} = A_3(R-2R^3+R^4)(-20Q+40Q^2-20Q^3) \qquad 3.181g$$

$$W_{xy}{}^{II} = A_1.\frac{d^2w}{dRdQ} = A_1(1-6R^2+4R^3)\left(\frac{7}{3} - 10Q^2 + \frac{40}{3}Q^3 - 5Q^4\right) \qquad 3.181h$$

Where $A_2 = \frac{P_2.A_1}{a}$ and $A_3 = \frac{P_3.A_1}{a\beta}$ 3.181i

3.3.1.8 Exact polynomial displacement function for CCFC rectangular plate

The boundary condition for this plate are as follows;

$$W(R = 0) = \frac{dw_{(R=0)}}{dR} = 0$$

$$W(R = 1) = \frac{dw_{(R=1)}}{dR} = 0$$

$$W(Q = 0) = \frac{dw_{(Q=0)}}{dQ} = 0$$

$$\frac{d^2w_{(Q=1)}}{dQ^2} = \frac{d^3w_{(Q=1)}}{dQ^3} = 0$$

$$\frac{dw_{(Q=1)}}{dQ} = \frac{2}{3\beta_5}$$

Applying these boundary conditions to Equation 3.180 and solving gives

$\alpha_0 = 0$; $\alpha_1 = 0$; $\alpha_2 = \alpha_4$; $\alpha_3 = -2\alpha_4$ and $\beta_0 = 0$; $\beta_1 = 0$; $\beta_2 = 2.8\beta_5$, $\beta_3 = -5.2\beta_5$; $\beta_4 = 3.8\beta_5$.

Substituting these constants back into equation 3.180 gives the expression of Equation 3.182b

$$w = \alpha_4.\beta_4 (R^2 - 2R^3 + R^4)(2.8Q^2 - 5.2Q^3 + 3.8Q^4 - Q^5)$$

$$w = A_1(R^2 - 2R^3 + R^4)(2.8Q^2 - 5.2Q^3 + 3.8Q^4 - Q^5) \quad 3.182b$$

Where $A_1 = \alpha_4.\beta_4$

The shape profile for CCFC plate is given as shown in Equation 3.182b

$$h = (R^2 - 2R^3 + R^4)(2.8Q^2 - 5.2Q^3 + 3.8Q^4 - Q^5) \quad 3.182b$$

Equation 3.182b was differentiated appropriately with respect to (R) and (Q) to obtain the required peculiar exact displacement functions for CCFC rectangular plates as shown in Equations 3.182c, 3.182d, 3.182e, 3.182f, 3.182g, 3.182h and 3.182i

$$w = A_1 h = A_1(R^2-2R^3+R^4)((2.8Q^2-5.2Q^3+3.8Q^4-Q^5) \quad 3.182c$$

$$\emptyset_x = A_2.\frac{dh}{dR} = A_2(2R-6R^2+4R^3)(2.8Q^2-5.2Q^3+3.8Q^4-Q^5) \quad 3.182d$$

$$\emptyset_y = A_3.\frac{dh}{dQ} = A_3(R^2-2R^3+R^4)(5.6Q-15.9Q^2+15.2Q^3-5Q^4) \quad 3.182e$$

$$\emptyset_x^{I} = A_2.\frac{d^2h}{dR^2} = A_2(2-12R+12R^2)(2.8Q^2 - 5.2Q^3 + 3.8Q^4 - Q^5) \quad 3.182f$$

$$\emptyset_y^{I} = A_3.\frac{d^2h}{dQ^2} = A_3(R^2-2R^3+R^4)(5.6-31.8Q+45.6Q^2-20Q^3) \quad 3.182g$$

$$W_{xy}^{II} = A_1.\frac{d^2w}{dRdQ} = A_1(2R-6R^2+4R^3)(5.6Q-15.9Q^2+15.2Q^3 - 5Q^4) \quad 3.182h$$

Where $A_2 = \frac{P_2.A_1}{a}$ and $A_3 = \frac{P_3.A_1}{a\beta}$ 3.182i

3.3.2.9 Exact polynomial displacement function for SCFS rectangular plate

The boundary condition for this plate are as follows;

$$W(R = 0) = \frac{dw_{(R=0)}}{dR} = 0$$

$$W(R = 1) = \frac{d^2 w_{(R=1)}}{dR^2} = 0$$

$$W(Q = 0) = \frac{d^2 w_{(Q=0)}}{dQ^2} = 0$$

$$\frac{d^2 w_{(Q=1)}}{dQ^2} = \frac{d^3 w_{(Q=1)}}{dQ^3} = 0$$

$$\frac{dw_{(Q=1)}}{dQ} = \frac{2}{3\beta_5}$$

Applying these boundary conditions to Equation 3.180 and solving gives

$\alpha_0 = 0$; $\alpha_1 = 0$; $\alpha_2 = 1.5\alpha_4$; $\alpha_3 = -2.5\alpha_4$ and $\beta_0 = 0$; $\beta_1 = \frac{7}{3}\beta_5$; $\beta_2 = 0$; $\beta_3 = -\frac{10}{3}\beta_5$, $\beta_4 = \frac{10}{3}\beta_5$.

Substituting these constants back into equation 3.180 gives the expression of Equation 3.183a

$$w = \alpha_4 . \beta_4 \, (1.5R^2 - 2.5R^3 + R^4) \, (\tfrac{7}{3}Q - \tfrac{10}{3}Q^3 + \tfrac{10}{3}Q^4 - Q^5)$$

$$w = A_1(1.5R^2 - 2.5R^3 + R^4) \, (\tfrac{7}{3}Q - \tfrac{10}{3}Q^3 + \tfrac{10}{3}Q^4 - Q^5) \qquad 3.183a$$

Where $A_1 = \alpha_4 . \beta_4$

The shape profile for SCFS plate is given as shown in Equation 3.183b

$$h = (1.5R^2 - 2.5R^3 + R^4) \, (\tfrac{7}{3}Q - \tfrac{10}{3}Q^3 + \tfrac{10}{3}Q^4 - Q^5) \qquad 3.183b$$

Equation 3.183b was differentiated appropriately with respect to (R) and (Q) to obtain the required peculiar exact displacement functions for SCFS rectangular plates as shown in Equations 3.183c, 3.183d, 3.183e, 3.183f, 3.183g, 3.183h and 3.183i

$$w = A_1 h = A_1(1.5R^2 - 2.5R^3 + R^4) \, (\tfrac{7}{3}Q - \tfrac{10}{3}Q^3 + \tfrac{10}{3}Q^4 - Q^5) \qquad 3.183c$$

$$\emptyset_x = A_2 . \frac{dh}{dR} = A_2(3R - 7.5R^2 + 4R^3) \, (\tfrac{7}{3}Q - \tfrac{10}{3}Q^3 + \tfrac{10}{3}Q^4 - Q^5) \qquad 3.183d$$

$$\emptyset_y = A_3 . \frac{dh}{dQ} = A_3(1.5R^2 - 2.5R^3 + R^4) \, (\tfrac{7}{3} - 10Q^2 + \tfrac{40}{3}Q^3 - 5Q^4) \qquad 3.183e$$

$$\emptyset_x{}^{I} = A_2 . \frac{d^2h}{dR^2} = A_2(3 - 15R + 12R^2)(\tfrac{7}{3}Q - \tfrac{10}{3}Q^3 + \tfrac{10}{3}Q^4 - Q^5) \qquad 3.183f$$

$$\emptyset_y{}^{I} = A_3 . \frac{d^2h}{dQ^2} = A_3(1.5R^2 - 2.5R^3 + R^4)(-20Q + 40Q^2 - 20Q^3) \qquad 3.183g$$

$$W_{xy}^{II} = A_1.\frac{d^2w}{dRdQ} = A_1(3R\text{-}7.5R^2\text{+}4R^3)(\frac{7}{3} - 10Q^2 + \frac{40}{3}Q^3\text{- }5Q^4) \quad 3.183h$$

$$\text{Where } A_2 = \frac{P_2.A_1}{a} \quad \text{and} \quad A_3 = \frac{P_3.A_1}{a\beta} \quad 3.183i$$

3.3.2.10 Exact polynomial displacement function for CSFS rectangular plate

The boundary condition for this plate are as follows;

$$W(R = 0) = \frac{d^2w_{(R=0)}}{dR^2} = 0$$

$$W(R = 1) = \frac{d^2w_{(R=1)}}{dR^2} = 0$$

$$W(Q = 0) = \frac{dw_{(Q=0)}}{dQ} = 0$$

$$\frac{d^2w_{(Q=1)}}{dQ^2} = \frac{d^3w_{(Q=1)}}{dQ^3} = 0$$

$$\frac{dw_{(Q=1)}}{dQ} = \frac{2}{3\beta_5}$$

Applying these boundary conditions to Equation 3.180 and solving gives

$\alpha_0 = 0$; $\alpha_1 = \alpha_4$; $\alpha_2 = 0$; $\alpha_3 = -2\alpha_4$ and $\beta_0 = 0$; $\beta_1 = 0$; $\beta_2 = 2.8\beta_5$, $\beta_3 = -5.2\beta_5$; $\beta_4 = 3.8\beta_5$.

Substituting these constants back into equation 3.180 gives the expression of Equation 3.184a

$$w = \alpha_4 . \beta_4 (R - 2R^3 + R^4)(2.8Q^2 - 5.2Q^3 + 3.8Q^4 - Q^5)$$

$$w = A_1(R - 2R^3 + R^4)(2.8Q^2 - 5.2Q^3 + 3.8Q^4 - Q^5) \quad 3.184a$$

Where $A_1 = \alpha_4 . \beta_4$

The shape profile for CSFS plate is given as shown in Equation 3.184b

$$h = (R - 2R^3 + R^4)(2.8Q^2 - 5.2Q^3 + 3.8Q^4 - Q^5) \quad 3.184b$$

Equation 3.184b was differentiated appropriately with respect to (R) and (Q) to obtain the required peculiar exact displacement functions for CSFS rectangular plates as shown in Equations 3.184c, 3.184d, 3.184e, 3.184f, 3.184g, 3.184h and 3.184i

$w = A_1 h = A_1(R-2R^3+R^4)(2.8Q^2-5.2Q^3+3.8Q^4-Q^5)$ 3.184c

$\emptyset_x = A_2.\frac{dh}{dR} = A_2(1-6R^2+4R^3)(2.8Q^2-5.2Q^3+3.8Q^4-Q^5)$ 3.184d

$\emptyset_y = A_3.\frac{dh}{dQ} = A_3(R-2R^3+R^4)(5.6Q-15.9Q^2+15.2Q^3-5Q^4)$ 3.184e

$\emptyset_x{}^I = A_2.\frac{d^2h}{dR^2} = A_2 12(R^2 - R)(2.8Q^2-5.2Q^3+3.8Q^4-Q^5)$ 3.184f

$\emptyset_y{}^I = A_3.\frac{d^2h}{dQ^2} = A_3(R-2R^3+R^4)(5.6-31.8Q+45.6Q^2-20Q^3)$ 3.184g

$W_{xy}{}^{II} = A_1.\frac{d^2w}{dRdQ} = A_3(1-6R^2+4R^3)(5.6Q-15.9Q^2+15.2Q^3-5Q^4)$ 3.184h

Where $A_2 = \frac{P_2.A_1}{a}$ and $A_3 = \frac{P_3.A_1}{a\beta}$ 3.184i

3.3.2.11 Exact polynomial displacement function for CCFS rectangular plate

The boundary condition for this plate are as follows;

$W(R=0) = \frac{dw_{(R=0)}}{dR} = 0$

$W(R=1) = \frac{d^2w_{(R=1)}}{dR^2} = 0$

$W(Q=0) = \frac{dw_{(Q=0)}}{dQ} = 0$

$\frac{d^2w_{(Q=1)}}{dQ^2} = \frac{d^3w_{(Q=1)}}{dQ^3} = 0$

$\frac{dw_{(Q=1)}}{dQ} = \frac{2}{3\beta_5}$

Applying these boundary conditions to Equation 3.180 and solving gives

$\alpha_0 = 0$; $\alpha_1 = 0$; $\alpha_2 = 1.5\alpha_4$; $\alpha_3 = -2.5\alpha_4$ and $\beta_0 = 0$; $\beta_1 = 0$; $\beta_2 = 2.8\beta_5$, $\beta_3 = -5.2\beta_5$; $\beta_4 = 3.8\beta_5$..

Substituting these constants back into equation 3.180 gives the expression of Equation 3.185a

$w = \alpha_4.\beta_4(1.5R^2 - 2.5R^3 + R^4)(2.8Q^2 - 5.2Q^3 + 3.8Q^4 - Q^5)$

$w = A_1(1.5R^2 - 2.5R^3 + R^4)(2.8Q^2 - 5.2Q^3 + 3.8Q^4 - Q^5)$ 3.185a

Where $A_1 = \alpha_4.\beta_4$

The shape profile for CSFS plate is given as shown in Equation 3.185b

$$h = (1.5R^2 - 2.5R^3 + R^4)(2.8Q^2 - 5.2Q^3 + 3.8Q^4 - Q^5) \qquad 3.185b$$

Equation 3.185b was differentiated appropriately with respect to (R) and (Q) to obtain the required peculiar exact displacement functions for CCFS rectangular plates as shown in Equations 3.185c, 3.185d, 3.185e, 3.185f, 3.185g, 3.185h and 3.185i

$$w = A_1 h = A_1(1.5R^2\text{-}2.5R^3\text{+}R^4)(2.8Q^2\text{-}5.2Q^3\text{+}3.8Q^4\text{-}Q^5) \qquad 3.185c$$

$$\emptyset_x = A_2.\frac{dh}{dR} = A_2(3R\text{-}7.5R^2\text{+}4R^3)(2.8Q^2\text{-}5.2Q^3\text{+}3.8Q^4\text{-}Q^5) \qquad 3.185d$$

$$\emptyset_y = A_3.\frac{dh}{dQ} = A_3(1.5R^2\text{-}2.5R^3\text{+}R^4)(5.6Q\text{-}15.9Q^2\text{+}15.2Q^3\text{-}5Q^4) \qquad 3.185e$$

$$\emptyset_x{}^I = A_2.\frac{d^2h}{dR^2} = A_2(3 - 15R + 12R^2)(2.8Q^2\text{-}5.2Q^3\text{+}3.8Q^4\text{-}Q^5) \qquad 3.185f$$

$$\emptyset_y{}^I = A_3.\frac{d^2h}{dQ^2} = A_3(1.5R^2\text{-}2.5R^3\text{+}R^4)(5.6\text{-}31.8Q\text{+}45.6Q^2\text{-}20Q^3) \qquad 3.185g$$

$$W_{xy}{}^{II} = A_1.\frac{d^2w}{dRdQ} = A_1(3R\text{-}7.5R^2\text{+}4R^3)(5.6Q\text{-}15.9Q^2\text{+}15.2Q^3\text{-}5Q^4) \qquad 3.185h$$

Where $A_2 = \frac{P_2.A_1}{a}$ and $A_3 = \frac{P_3.A_1}{a\beta}$ 3.185i

3.3.1.12 Exact polynomial displacement function for SCFC Rectangular Plate

The boundary condition for this plate are as follows;

$$W(R = 0) = \frac{dw_{(R=0)}}{dR} = 0$$

$$W(R = 1) = \frac{dw_{(R=1)}}{dR} = 0$$

$$W(Q = 0) = \frac{d^2w_{(Q=0)}}{dQ^2} = 0$$

$$\frac{d^2w_{(Q=1)}}{dQ^2} = \frac{d^3w_{(Q=1)}}{dQ^3} = 0$$

$$\frac{dw_{(Q=1)}}{dQ} = \frac{2}{3\beta_5}$$

Applying these boundary conditions to Equation 3.180 and solving gives

$\alpha_0 = 0$; $\alpha_1 = 0$; $\alpha_2 = \alpha_4$; $\alpha_3 = -2\alpha_4$ and $\beta_0 = 0$; $\beta_1 = \frac{7}{3}\beta_5$; $\beta_2 = 0$; $\beta_3 = -\frac{10}{3}\beta_5$, $\beta_4 = \frac{10}{3}\beta_5$.

Substituting these constants back into equation 3.180 gives the expression as shown in Equation 3.186a

$$w = \alpha_4 . \beta_4 \, (R^2 - 2R^3 + R^4) \, (\tfrac{7}{3}Q - \tfrac{10}{3}Q^3 + \tfrac{10}{3}Q^4 - Q^5)$$

$$w = A_1(R^2 - 2R^3 + R^4) \, (\tfrac{7}{3}Q - \tfrac{10}{3}Q^3 + \tfrac{10}{3}Q^4 - Q^5) \qquad 3.186a$$

Where $A_1 = \alpha_4 . \beta_4$

The shape profile for SCFC plate is given as shown in Equation 3.186b

$$h = (1.52R^2 - 2.5R^3 + R^4) \, (2.8Q^2 - 5.2Q^3 + 3.8Q^4 - Q^5) \qquad 3.186b$$

Equation 3.186b was differentiated appropriately with respect to (R) and (Q) to obtain the required peculiar exact displacement functions for SCFC rectangular plates as shown in Equations 3.186c, 3.186d, 3.186e, 3.186f, 3.186g, 3.186h and 3.186i

$$w = A_1 h = A_1(R^2 - 2R^3 + R^4)(\tfrac{7}{3}Q - \tfrac{10}{3}Q^3 + \tfrac{10}{3}Q^4 - Q^5) \qquad 3.186c$$

$$\emptyset_x = A_2 . \frac{dh}{dR} = A_2(2R - 6R^2 + 4R^3)(\tfrac{7}{3}Q - \tfrac{10}{3}Q^3 + \tfrac{10}{3}Q^4 - Q^5) \qquad 3.186d$$

$$\emptyset_y = A_3 . \frac{dh}{dQ} = A_3(R^2 - 2R^3 + R^4)(\tfrac{7}{3} - 10Q^2 + \tfrac{40}{3}Q^3 - 5Q^4) \qquad 3.186e$$

$$\emptyset_x^{I} = A_2 . \frac{d^2h}{dR^2} = A_2(2 - 12R + 12R^2)(\tfrac{7}{3}Q - \tfrac{10}{3}Q^3 + \tfrac{10}{3}Q^4 - Q^5) \qquad 3.186f$$

$$\emptyset_y^{I} = A_3 . \frac{d^2h}{dQ^2} = A_3(R^2 - 2R^3 + R^4)(-20Q + 40Q^2 - 20Q^3) \qquad 3.186g$$

$$W_{xy}^{II} = A_1 . \frac{d^2w}{dRdQ} = A_1(2R - 6R^2 + 4R^3)(\tfrac{7}{3} - 10Q^2 + \tfrac{40}{3}Q^3 - 5Q^4) \qquad 3.186h$$

Where $A_2 = \frac{P_2 . A_1}{a}$ and $A_3 = \frac{P_3 . A_1}{a\beta}$ 3.186i

3.3.2 Determination of stiffness coefficients

The stiffness coefficients (k) extracted from Equation 3.149 were solved for twelve boundary conditions and the unique stiffness coefficient values were obtained as shown:

3.3.2.1 Calculation of the stiffness coefficients of SSSS rectangular plate

Substituting the shape profile of equation 3.173f into equations 3.150 to 3.157 and integrating appropriately gives the stiffness coefficients for SSSS plate as shown in Equations 3.187a, 3.187b, 3.187c, 3.187d, 3.187e, 3.187f, 3.187g and 3.187h

$$k_1 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\, dQ \;\; = 0.23619 \qquad 3.187a$$

$$k_2 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dRdQ}\right)^2 dR\, dQ \;\; = 0.23592 \qquad 3.187b$$

$$k_3 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)^2 dR\, dQ \;\; = 0.23619 \qquad 3.187c$$

$$k_4 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ \;\; = \;\; 0 \qquad 3.187d$$

$$k_5 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ \;\; = 0 \qquad 3.187e$$

$$k_6 = \int_0^1 \int_0^1 \left(\frac{dh}{dR}\right)^2 dR\, dQ \;\; = 0.0239 \qquad 3.187f$$

$$k_7 = \int_0^1 \int_0^1 \left(\frac{dh}{dQ}\right)^2 dR\, dQ = \;\; 0.0239 \qquad 3.187g$$

$$k_8 = \int_0^1 \int_0^1 h\, dR\, dQ \;\; = \;\; 0.04000 \qquad 3.187h$$

The “k” values can be obtained as follows

$$h = (R\text{-}2R^3\text{+}R^4)(Q\text{-}2Q^3\text{+}Q^4) \qquad 3.187i$$

$$\frac{dh}{dR} = (1\text{-}6R^2\text{+}4R^3)(Q\text{-}2Q^3\text{+}Q^4) \qquad 3.187ii$$

$$\frac{dh}{dQ} = (R\text{-}2R^3\text{+}R^4)\,(1\text{-}6Q^2\text{+}4Q^3) \qquad 3.187iii$$

$$\frac{d^2h}{dR^2} = (R^2\text{-}R)(Q\text{-}2Q^3\text{+}Q^4).12 \qquad 3.187iv$$

$$\frac{d^2h}{dQ^2} = (R\text{-}2R^3\text{+}R^4)(Q^2\text{-}Q).12 \qquad 3.187v$$

$\frac{d^2w}{dRdQ}$ = (1-6R^2+4R^3)(1-6Q^2+4Q^3) 3.187vi

$\frac{d^4h}{dR^4} = 24.(R^2-R)(Q-2Q^3+Q^4)$ 3.187vii

$h.\frac{d^4h}{dR^4} = 24.(R-2R^3+R^4)(Q-2Q^3+Q^4)^2 = 24.(R-2R^3+R^4)(Q^2- 4Q^4+2Q^5 + 4Q^6 - 4Q^7 + Q^8)$

3.187viii

Note that; $k_1 = \int_0^1\int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\,dQ = \int_0^1\int_0^1 h.\frac{d^4h}{dR^4}.dR\,dQ$ 3.187ix

Integrating equation 3.187viii in a close domain with respect to 'R' and 'Q' gives Equation 3.187x

$k_1= h.\frac{d^4h}{dR^4} = 24.[\frac{R^2}{2} - \frac{R^4}{4} + \frac{R^5}{5}].[\frac{Q^3}{3} - \frac{4Q^5}{5} + \frac{2Q^6}{6} + \frac{4Q^7}{7} - \frac{4Q^8}{8} + \frac{Q^9}{9}]$ 3.187x

$k_1 = h.\frac{d^4h}{dR^4} = 24.[\frac{1}{2} - \frac{1}{2} + \frac{1}{5}].[\frac{1}{3} - \frac{4}{5} + \frac{2}{6} + \frac{4}{7} - \frac{4}{8} + \frac{1}{9}]$ = 24*0.2*0.0492063 = 0.23619 3.187xi

k_3 can be obtained in a similar solution as shown;

$k_3 = \int_0^1\int_0^1 \left(\frac{d^2h}{dQ^2}\right)^2 dR\,dQ = \int_0^1\int_0^1 h.\frac{d^4h}{dQ^4}.dR\,dQ$ 3.187xii

$k_3 = \int_0^1\int_0^1 24.(R^2 - 4R^4 + 2R^5 + 4R^6 - 4R^7 + R^8).(Q - 2Q^3 + Q^4).dR\,dQ$ 3.187xiii

Integrating Equation 3.187xiii in a close domain gives 3.187xiv;

$k_3 = \int_0^1\int_0^1 h.\frac{d^4h}{dQ^4}.dR\,dQ = [\frac{1}{3} - \frac{4}{5} + \frac{2}{6} + \frac{4}{7} - \frac{4}{8} + \frac{1}{9}]_0^1.[\frac{1}{2} - \frac{1}{2} + \frac{1}{5}]$ 3.187xiv

= 24*0.0492063*0.2 = 0.23619 3.187xv

$k_2 = \int_0^1\int_0^1 \left(\frac{d^2h}{dRdQ}\right)^2 dR\,dQ = \int_0^1\int_0^1 h.\frac{d^4h}{dR^2dQ^2}.dR\,dQ$ 3.187xvi

$k_2 = \int_0^1\int_0^1 144.(-R^2 + R^3 + 2R^4 - 3R^5 + R^6).(-Q^2 + Q^3 + 2Q^4 - 3Q^5 + Q^6).dR\,dQ$

3.187xvii

Integrating Equation 3.187vii in a close domain gives 3.187xviii;

$k_2 = \int_0^1\int_0^1 h.\frac{d^4h}{dQ^4}.dR\,dQ = 144.[-\frac{1}{3} + \frac{1}{4} + \frac{2}{5} - \frac{3}{6} + \frac{1}{7}].[-\frac{1}{3} + \frac{1}{4} + \frac{2}{5} - \frac{3}{6} + \frac{1}{7}]$ 3.187z

= 144*(- 0.0404762) *(- 0.0404762) = 0.23592 3.187xviii

$k_4 = \int_0^1 \int_0^1 \frac{d^2h}{dR^2} \cdot \frac{d^2h}{dRdQ}\ dR\ dQ$ 3.187xix

$k_4 = \int_0^1 \int_0^1\ 12. [(R^2 - R)(Q - 2Q^3 + Q^4)]_0^1[(1 - 6R^2 + 4R^3).(1 - 6Q^2 + 4Q^3)]_0^1 . dR\ dQ$

3.187xx

Integrating Equation 3.187xx in a close domain gives 3.187xxi;

$k_4 = \int_0^1 \int_0^1 \frac{d^2h}{dR^2} \cdot \frac{d^2h}{dRdQ} . dR\ dQ = 12.[(\frac{1}{3} - \frac{1}{2})(\frac{1}{2} - \frac{1}{2} + \frac{1}{5})].[(1 - 2 + 1)(1 - 2 + 1)]$ 3.187xxii

= 12*[(- 0.166667) *(0.2)][0.0*0.0] = 0.0 3.187xxiii

Similarly;

$k_5 = \int_0^1 \int_0^1 \frac{d^2h}{dR^2} \cdot \frac{d^2h}{dRdQ} . dR\ dQ = 0.0$ 3.187xxiv

$k_6 = \int_0^1 \int_0^1 \left(\frac{dh}{dR}\right)^2 dR\ dQ = \int_0^1 \int_0^1 \{(1 - 6R^2 + 4R^3)(Q - 2Q^3 + Q^4)\}^2 . dR\ dQ$ 3.187xxv

$k_6 = \int_0^1 \int_0^1 [(1 - 12R^2 + 8R^3 + 36R^4 - 48R^5 + 16R^6)]_0^1 . [(Q^2 - 4Q^4 + 2Q^5 + 4Q^6 - 4Q^7 + Q^8)]_0^1 . dR\ dQ$ 3.187xxvi

Integrating Equation 3.187xxvi in a close domain gives 3.187xxvii;

$k_6 = \int_0^1 \int_0^1 \left(\frac{dh}{dR}\right)^2 dR\ dQ = [1 - \frac{12}{3} + \frac{8}{4} + \frac{36}{5} - \frac{48}{6} + \frac{16}{7}].[\frac{1}{3} - \frac{4}{5} + \frac{2}{6} + \frac{4}{7} - \frac{4}{8} + \frac{1}{9}]$

3.187xxvii

= (0.48571429) *(0.049206349) = 0.02390022675 3.187xxviii

Similarly;

$k_7 = \int_0^1 \int_0^1 \left(\frac{dh}{dR}\right)^2 dR\ dQ = \int_0^1 \int_0^1 \frac{dh}{dQ} . \frac{dh}{dQ} dR\ dQ = 0.02390022675$ 3.187xxix

$k_8 = \int_0^1 \int_0^1 h\ dR\ dQ = \int_0^1 \int_0^1 (R - 2R^3 + R^4)(Q - 2Q^3 + Q^4)\ dR\ dQ$ 3.187xxx

Integrating Equation 3.187xxx in a close domain gives 3.187xxxi;

$k_8 = \int_0^1 \int_0^1 h\ dR\ dQ = [\frac{1}{2} - \frac{1}{2} + \frac{1}{5}].[\frac{1}{2} - \frac{1}{2} + \frac{1}{5}] = \frac{1}{5} * \frac{1}{5} = 0.0400$ 3.187xxxi

3.3.2.2 Calculation of the stiffness coefficients of CCCC rectangular plate

Substituting the shape profile of Equation 3.175b into Equations 3.150 to 3.157 appropriately gives the stiffness coefficients for CCCC rectangular plate as shown in Equations 3.188a, 3.188b, 3.188c, 3.188d, 3.188e, 3.188f, 3.188g and 3.188h

$$k_1 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\, dQ \;= 0.00126 \qquad 3.188a$$

$$k_2 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dRdQ}\right)^2 dR\, dQ \;= 0.00036 \qquad 3.188b$$

$$k_3 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)^2 dR\, dQ \;= 0.00127 \qquad 3.188c$$

$$k_4 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ \;= \;0 \qquad 3.188d$$

$$k_5 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ \;= 0 \qquad 3.188e$$

$$k_6 = \int_0^1 \int_0^1 \left(\frac{dh}{dR}\right)^2 dR\, dQ \;= 0.00003 \qquad 3.188f$$

$$k_7 = \int_0^1 \int_0^1 \left(\frac{dh}{dQ}\right)^2 dR\, dQ = \;0.00003 \qquad 3.188g$$

$$k_8 = \int_0^1 \int_0^1 h\, dR\, dQ \;= \;0.00111 \qquad 3.188h$$

The “k” values can be obtained as follows;

$$k_1 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\, dQ \;=\; \int_0^1 \int_0^1 h.\frac{d^4h}{dR^4}\,.dR\, dQ \qquad 3.188i$$

$$h. = (R^2\text{-}2R^3\text{+}R^4)(Q^2 - 2Q^3 + Q^4) \qquad 3.188ii$$

Differentiating to fourth order and multiplying with Equation 3.188ii gives;

$$k_1 = \int_0^1 \int_0^1 h.\frac{d^4h}{dR^4}\,.dR\, dQ = \int_0^1 \int_0^1 24(R^2 - 2R^3 + R^4)\,(Q^4 - 4Q^5 + 6Q^6 - 4Q^7 + Q^8)\,.dR\, dQ \qquad 3.188iii$$

$k_1 = h.\frac{d^4h}{dR^4} = 24.[\frac{R^3}{3} - \frac{2R^4}{4} + \frac{R^5}{5}]_0^1. [\frac{Q^5}{5} - \frac{4Q^6}{6} + \frac{6Q^7}{7} - \frac{4Q^8}{8} + \frac{Q^9}{9}]_0^1$ 3.188iv

$k_1 = h.\frac{d^4h}{dR^4} = 24.[\frac{1}{3} - \frac{2}{4} + \frac{1}{5}]. [\frac{1}{5} - \frac{4}{6} + \frac{6}{7} - \frac{4}{8} + \frac{1}{9}]$

= 24*0.0333*0.001587 = 0.00126 3.188v

Similarly, k_2, k_3, k_4, k_5, k_6, k_7 and k_8 were also calculated.

3.3.2.3 Calculation of the stiffness coefficients of CSSS rectangular plate

Substituting the shape profile of equation 3.176b into Equations 3.150 to 3.157 appropriately gives the stiffness coefficients for CSSS rectangular plate as shown in Equations 3.189a, 3.189b, 3.189c, 3.189d, 3.189e, 3.189f, 3.189g and 3.189h

$$k_1 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\, dQ = 0.03619 \quad 3.189a$$

$$k_2 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dRdQ}\right)^2 dR\, dQ = 0.04163 \quad 3.189b$$

$$k_3 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)^2 dR\, dQ = 0.08857 \quad 3.189c$$

$$k_4 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ = 0 \quad 3.189d$$

$$k_5 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ = 0 \quad 3.189e$$

$$k_6 = \int_0^1 \int_0^1 \left(\frac{dh}{dR}\right)^2 dR\, dQ = 0.00366 \quad 3.189f$$

$$k_7 = \int_0^1 \int_0^1 \left(\frac{dh}{dQ}\right)^2 dR\, dQ = 0.00422 \quad 3.189g$$

$$k_8 = \int_0^1 \int_0^1 h\, dR\, dQ = 0.01500 \quad 3.189h$$

The "k" values can be obtained as follows;

$k_1 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\, dQ \;=\; \int_0^1 \int_0^1 h.\frac{d^4h}{dR^4}\,.dR\, dQ$ 3.189i

$h. \;=\; (R\text{-}2R^3\text{+}R^4)(1.5Q^2 - 2.5Q^3 + Q^4)$ 3.189ii

Differentiating to fourth order and multiplying with Equation 3.189ii gives;

$k_1 \;=\; \int_0^1 \int_0^1 h.\frac{d^4h}{dR^4}\,.dR\, dQ \;=\; \int_0^1 \int_0^1 24(R - 2R^3 + R^4)\,(2.25Q^4 - 7.5Q^5 + 9.25Q^6 + Q^8)\,.dR\, dQ$

3.189iii

$k_1 = h.\frac{d^4h}{dR^4} = 24.[\frac{R^2}{2} - \frac{2R^4}{4} + \frac{R^5}{5}].[\frac{2.25Q^5}{5} - \frac{7.5Q^6}{6} + \frac{9.25Q^7}{7} - \frac{5Q^8}{8} + \frac{Q^9}{9}]$

3.189iv

$k_1 = h.\frac{d^4h}{dR^4} = 24.[\frac{1}{2} - \frac{2}{4} + \frac{1}{5}].[\frac{2.25}{5} - \frac{7.5}{6} + \frac{9.25}{7} - \frac{5}{8} + \frac{1}{9}]$

$= 24*0.2*0.00753968 = 0.036192$ 3.189v

Similarly, k_2, k_3, k_4, k_5, k_6, $k_7$and k_8 were also calculated.

3.3.2.4 Calculation of the stiffness coefficients of CCSS rectangular plates

Substituting the shape profile of Equation 3.177b into Equations 3.150 to 3.157 and integrating appropriately gives the stiffness coefficients for CCSS rectangular plates as shown in Equations 3.190a, 3.190b, 3.190c, 3.190d, 3.190e, 3.190f, 3.190g and 3.190h

$$k_1 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\, dQ \;=0.01357 \qquad 3.190a$$

$$k_2 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dRdQ}\right)^2 dR\, dQ \;=0.00735 \qquad 3.190b$$

$$k_3 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)^2 dR\, dQ \;=0.01357 \qquad 3.190c$$

$$k_4 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ \;=\; 0 \qquad 3.190d$$

$$k_5 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ \;=0 \qquad 3.190e$$

$$k_6 = \int_0^1 \int_0^1 \left(\frac{dh}{dR}\right)^2 dR\,dQ \;= 0.00065 \qquad 3.190f$$

$$k_7 = \int_0^1 \int_0^1 \left(\frac{dh}{dQ}\right)^2 dR\,dQ = \;\; 0.00065 \qquad 3.190g$$

$$k_8 = \int_0^1 \int_0^1 h\,dR\,dQ \;=\;\; 0.00563 \qquad 3.190h$$

The "k" values can be obtained as follows;

$$k_1 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\,dQ \;=\; \int_0^1 \int_0^1 h.\frac{d^4h}{dR^4}\,.dR\,dQ \qquad 3.190i$$

$$h. \;=\; (1.5R^2\text{-}2.5R^3\text{+}R^4)(1.5Q^2 - 2.5Q^3 + Q^4) \qquad 3.190ii$$

Differentiating to fourth order and multiplying with Equation 3.190ii gives;

$$k_1 \;=\; \int_0^1 \int_0^1 h.\frac{d^4h}{dR^4}\,.dR\,dQ \;=\; \int_0^1 \int_0^1 24(1.5R^2 - 2.5R^3 + R^4)\,(2.25Q^4 - 7.5Q^5 + 9.25Q^6 \;-\; 5Q^7 \;+ Q^8)\,.dR\,dQ \qquad 3.190iii$$

$$k_1\text{=}\,h.\frac{d^4h}{dR^4} \;= 24.\left[\frac{1.5R^3}{3}\text{-}\frac{2.5R^4}{4} + \frac{R^5}{5}\right]_0^1.\left[\frac{2.25Q^5}{5}\text{-}\frac{7.5Q^6}{6} + \frac{9.25Q^7}{7} - \frac{5Q^8}{8} + \frac{Q^9}{9}\right]_0^1 \qquad 3.190iv$$

$$k_1 = h.\frac{d^4h}{dR^4} \;= 24.\left[\frac{1.5}{3}\text{-}\frac{2.5}{4} + \frac{1}{5}\right].\left[\frac{2.25}{5}\text{-}\frac{7.5}{6} + \frac{9.25}{7}\text{-}\frac{5}{8} + \frac{1}{9}\right]$$

$$= 24*0.075*0.00753968 = \; 0.013571 \qquad 3.190v$$

Similarly, k_2, k_3, k_4, k_5, k_6, $k_7$and k_8 were also calculated.

3.3.2.5 Calculation of the stiffness coefficients of CSCS rectangular plates

Substituting the shape profile of Equation 3.178b into Equations 3.150 to 3.157 and integrating appropriately gives the stiffness coefficients for CSCS rectangular plate as shown in Equations 3.191a, 3.191b, 3.191c, 3.191d, 3.191e, 3.191f, 3.191g and 3.191h

$$k_1 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\,dQ \;\; = 0.007763 \qquad 3.191a$$

$$k_2 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dRdQ}\right)^2 dR\, dQ = 0.00925 \quad 3.191b$$

$$k_3 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)^2 dR\, dQ = 0.03937 \quad 3.191c$$

$$k_4 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ = 0 \quad 3.191d$$

$$k_5 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ = 0 \quad 3.191e$$

$$k_6 = \int_0^1 \int_0^1 \left(\frac{dh}{dR}\right)^2 dR\, dQ = 0.000937 \quad 3.191f$$

$$k_7 = \int_0^1 \int_0^1 \left(\frac{dh}{dQ}\right)^2 dR\, dQ = 0.000771 \quad 3.191g$$

$$k_8 = \int_0^1 \int_0^1 h\, dR\, dQ = 0.00667 \quad 3.191h$$

The "k" values can be obtained as follows;

$$k_1 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\, dQ = \int_0^1 \int_0^1 h.\frac{d^4h}{dR^4}\, .dR\, dQ \quad 3.191i$$

$$h. = (R - 2R^3 + R^4)(Q^2 - 2Q^3 + Q^4) \quad 3.191ii$$

Differentiating to fourth order and multiplying with Equation 3.191ii gives;

$$k_1 = \int_0^1 \int_0^1 h.\frac{d^4h}{dR^4}\, .dR\, dQ = \int_0^1 \int_0^1 24(R - 2R^3 + R^4)\,(Q^4 - 4Q^5 + 6Q^6 - 4Q^7 + Q^8)\, .dR\, dQ$$

3.191iii

$$k_1 = h.\frac{d^4h}{dR^4} = 24.\left[\frac{R^2}{2} - \frac{2R^4}{4} + \frac{R^5}{5}\right]_0^1 . \left[\frac{Q^5}{5} - \frac{4Q^6}{6} + \frac{6Q^7}{7} - \frac{4Q^8}{8} + \frac{Q^9}{9}\right]_0^1 \quad 3.191iv$$

$$k_1 = h.\frac{d^4h}{dR^4} = 24.\left[\frac{1}{2} - \frac{2}{4} + \frac{1}{5}\right].\left[\frac{1}{5} - \frac{4}{6} + \frac{6}{7} - \frac{4}{8} + \frac{1}{9}\right]$$

$$= 24*0.2*0.001587 = 0.007763 \quad 3.191v$$

Similarly, k_2, k_3, k_4, k_5, k_6, $k_7$and k_8 were also calculated.

3.3.2.6 Calculation of the stiffness coefficients of CCCS rectangular plate

Substituting the shape profile of Equation 3.179b into Equations 3.150 to 3.157 and integrating appropriately gives the stiffness coefficients for CCCS rectangular plate as shown in Equations 3.192a, 3.192b, 3.192c, 3.192d, 3.192e, 3.192f, 3.192g and 3.192h

$$k_1 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\, dQ = 0.00286 \qquad 3.192a$$

$$k_2 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dRdQ}\right)^2 dR\, dQ = 0.00163 \qquad 3.192b$$

$$k_3 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)^2 dR\, dQ = 0.00603 \qquad 3.192c$$

$$k_4 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ = 0 \qquad 3.192d$$

$$k_5 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ = 0 \qquad 3.192e$$

$$k_6 = \int_0^1 \int_0^1 \left(\frac{dh}{dR}\right)^2 dR\, dQ = 0.00014 \qquad 3.192f$$

$$k_7 = \int_0^1 \int_0^1 \left(\frac{dh}{dQ}\right)^2 dR\, dQ = 0.00014 \qquad 3.192g$$

$$k_8 = \int_0^1 \int_0^1 h\, dR\, dQ = 0.00250 \qquad 3.192h$$

The “k” values can be obtained as follows;

$$k_1 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\, dQ = \int_0^1 \int_0^1 h.\frac{d^4h}{dR^4}\, .dR\, dQ \qquad 3.192i$$

$$h. = (1.5R^2 - 2.5R^3 + R^4)(Q^2 - 2Q^3 + Q^4) \qquad 3.192ii$$

Differentiating to fourth order and multiplying with Equation 3.192ii gives;

$$k_1 = \int_0^1\int_0^1 h.\frac{d^4h}{dR^4}.dR\,dQ = \int_0^1\int_0^1 24(1.5R^2 - 2.5R^3 + R^4)(Q^4 - 4Q^5 + 6Q^6 - 4Q^7 + Q^8).dR\,dQ \quad 3.192iii$$

$$k_1 = h.\frac{d^4h}{dR^4} = 24.[\frac{1.5R^3}{3} - \frac{2.5R^4}{4} + \frac{R^5}{5}]_0^1.[\frac{Q^5}{5} - \frac{4Q^6}{6} + \frac{6Q^7}{7} - \frac{4Q^8}{8} + \frac{Q^9}{9}]_0^1 \quad 3.192iv$$

$$k_1 = h.\frac{d^4h}{dR^4} = 24.[\frac{1.5}{3} - \frac{2.5}{4} + \frac{1}{5}].[\frac{1}{5} - \frac{4}{6} + \frac{6}{7} - \frac{4}{8} + \frac{1}{9}]$$

$$= 24*0.075*0.0015873 = 0.0028571 \quad 3.192v$$

Similarly, k_2, k_3, k_4, k_5, k_6, $k_7$and k_8 were also calculated.

3.3.2.7 Calculation of the stiffness coefficients of SSFS rectangular plate

Substituting the shape profile of Equation 3.181b into Equations 3.150 to 3.157 and integrating appropriately gives the stiffness coefficients for SSFS rectangular plate as shown in Equations 3.193a, 3.193b, 3.193c, 3.193d, 3.193e, 3.193f, 3.193g and 3.193h

$$k_1 = \int_0^1\int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\,dQ = 4.02578 \quad (3.193a)$$

$$k_2 = \int_0^1\int_0^1 \left(\frac{d^2h}{dRdQ}\right)^2 dR\,dQ = 1.033107 \quad (3.193b)$$

$$k_3 = \int_0^1\int_0^1 \left(\frac{d^2h}{dQ^2}\right)^2 dR\,dQ = 0.18746 \quad 3.193c)$$

$$k_4 = \int_0^1\int_0^1 \left(\frac{d^2h}{dR^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\,dQ = 0 \quad 3.193d$$

$$k_5 = \int_0^1\int_0^1 \left(\frac{d^2h}{dQ^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\,dQ = 0 \quad 3.193e$$

$$k_6 = \int_0^1\int_0^1 \left(\frac{dh}{dR}\right)^2 dR\,dQ = 0.407371 \quad 3.193f$$

$$k_7 = \int_0^1\int_0^1 \left(\frac{dh}{dQ}\right)^2 dR\,dQ = 0.104661 \quad 3.193g$$

$$k_8 = \int_0^1\int_0^1 h\,dR\,dQ = 0.16667 \quad 3.193h$$

The “k” values can be obtained as follows;

$$k_1 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\, dQ \;=\; \int_0^1 \int_0^1 h.\frac{d^4h}{dR^4}\,.dR\, dQ \qquad 3.193i$$

$$h. \;=\; (R - 2R^3+R^4)(\frac{7Q}{3} - \frac{10Q^3}{3} + \frac{10Q^4}{3} - Q^5) \qquad 3.193ii$$

Differentiating to fourth order and multiplying with Equation 3.193ii gives;

$$k_1 \;=\; \int_0^1 \int_0^1 h.\frac{d^4h}{dR^4}\,.dR\, dQ \;=\; \int_0^1 \int_0^1 24(R - 2R^3 + R^4)\,(\frac{49Q^2}{9} - \frac{140Q^4}{9} + \frac{140Q^5}{9} + \frac{59Q^6}{9} - \frac{200Q^7}{9} + \frac{160Q^8}{9} - \frac{20Q^9}{3} + Q^{10})\,.dR\, dQ \qquad 3.193iii$$

$$k_1 = h.\frac{d^4h}{dR^4} \;=\; 24.[\frac{R^2}{2} - \frac{2R^4}{4} + \frac{R^5}{5}]_0^1.\,[\frac{49Q^3}{27} - \frac{140Q^5}{45} + \frac{140Q^6}{54} + \frac{59Q^7}{63} - \frac{200Q^8}{72} + \frac{160Q^9}{81} - \frac{20Q^{10}}{30} + \frac{Q^{11}}{99}]_0^1 \qquad 3.193iv$$

$$k_1 = h.\frac{d^4h}{dR^4} \;=\; 24.[\frac{1}{2} - \frac{2}{4} + \frac{1}{5}].\,[\frac{49}{27} - \frac{140}{45} + \frac{140}{54} + \frac{59}{63} - \frac{200}{72} + \frac{160}{81} - \frac{20}{30} + \frac{1}{99}]$$

$$= 24*0.2*0.773769 = 4.025782 \qquad 3.193v$$

Similarly, k_2, k_3, k_4, k_5, k_6, $k_7$and k_8 were also calculated.

3.3.2.8 Calculation of the stiffness coefficients of CCFC rectangular plate

Substituting the shape profile of Equation 3.182b into Equations 3.150 to 3.157 and integrating appropriately gives the stiffness coefficients for CCFC rectangular plate as shown in Equations 3.194a, 3.194b, 3.194c, 3.194d, 3.194e, 3.194f, 3.194g and 3.194h

$$k_1 \;=\; \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\, dQ \;=\; 0.05474632 \qquad 3.194a$$

$$k_2 \;=\; \int_0^1 \int_0^1 \left(\frac{d^2h}{dRdQ}\right)^2 dR\, dQ \;=\; 0.195918 \qquad 3.194b$$

$$k_3 \;=\; \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)^2 dR\, dQ \;=\; 0.045714 \qquad 3.194c$$

$$k_4 \;=\; \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ \;=\; 0 \qquad 3.194d$$

$$k_5 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ \;=\; 0 \qquad 3.194e$$

$$k_6 \;=\; \int_0^1 \int_0^1 \left(\frac{dh}{dR}\right)^2 dR\, dQ \;=\; 0.0440211 \qquad 3.194f$$

$$k_7 = \int_0^1 \int_0^1 \left(\frac{dh}{dQ}\right)^2 dR\, dQ = 0.0163265 \qquad 3.194g$$

$$k_8 = \int_0^1 \int_0^1 h\, dR\, dQ = 0.04000 \qquad 3.194h$$

The "k" values can be obtained as follows;

$$k_1 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\, dQ = \int_0^1 \int_0^1 h.\frac{d^4h}{dR^4}\, .dR\, dQ \qquad 3.194i$$

$$h. = (R^2\text{-}2R^3\text{+}R^4)(2.8Q^2 - 5.2Q^3 + 3.8Q^4 - Q^5) \qquad 3.194ii$$

Differentiating to fourth order and multiplying with Equation 3.194ii gives;

$$k_1 = \int_0^1 \int_0^1 h.\frac{d^4h}{dR^4}\, .dR\, dQ = \int_0^1 \int_0^1 24(R^2 - 2R^3 + R^4)\,(7.84Q^4 - 29.12Q^5 + 48.32Q^6 - 45.12Q^7 + 24.84Q^8 - 7.6Q^9 + Q^{10})\, .dR\, dQ \qquad 3.194iii$$

$$k_1 = h.\frac{d^4h}{dR^4} = 24.\left[\frac{R^3}{3} - \frac{2R^4}{4} + \frac{R^5}{5}\right]_0^1 .\left[\frac{7.84Q^5}{5} - \frac{29.12Q^6}{6} + \frac{48.32Q^7}{7} - \frac{45.12Q^8}{8} + \frac{24.84Q^9}{9} - \frac{7.6Q^{10}}{10} + \frac{Q^{11}}{11}\right]_0^1$$

3.194iv

$$k_1 = h.\frac{d^4h}{dR^4} = 24.\left[\frac{1}{3} - \frac{2}{4} + \frac{1}{5}\right].\left[\frac{7.84}{5} - \frac{29.12}{6} + \frac{48.32}{7} - \frac{45.12}{8} + \frac{24.84}{9} - \frac{7.6}{10} + \frac{1}{11}\right]$$

$$= 24*0.333333*0.0684329 = 0.05474632 \qquad 3.194v$$

Similarly, k_2, k_3, k_4, k_5, k_6, $k_7$and k_8 were also calculated.

3.3.2.9 Calculation of the stiffness coefficients of SCFS rectangular plate

Substituting the shape profile of Equation 3.183b into Equations 3.150 to 3.157 and integrating appropriately gives the stiffness coefficients for SCFS rectangular plate as shown in Equations 3.195a, 3.195b, 3.195c, 3.195d, 3.195e, 3.195f, 3.195g and 3.195h

$$k_1 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\, dQ = 0.6190152 \qquad 3.195a$$

$$k_2 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dRdQ}\right)^2 dR\, dQ = 0.1823129 \qquad 3.195b$$

$$k_3 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)^2 dR\, dQ = 0.02872 \qquad 3.195c$$

$$k_4 = \int_0^1\int_0^1 \left(\frac{d^2h}{dR^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ = 0.11111 \quad 3.195d$$

$$k_5 = \int_0^1\int_0^1 \left(\frac{d^2h}{dQ^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ = 0 \quad 3.195e$$

$$k_6 = \int_0^1\int_0^1 \left(\frac{dh}{dR}\right)^2 dR\, dQ = 0.071889 \quad 3.195f$$

$$k_7 = \int_0^1\int_0^1 \left(\frac{dh}{dQ}\right)^2 dR\, dQ = 0.016033 \quad 3.195g$$

$$k_8 = \int_0^1\int_0^1 h\, dR\, dQ = 0.0625 \quad 3.195h$$

The "k" values can be obtained as follows;

$$k_1 = \int_0^1\int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\, dQ = \int_0^1\int_0^1 h.\frac{d^4h}{dR^4}.dR\, dQ \quad 3.195i$$

$$h. = (1.5R^2 - 2.5R^3 + R^4)\left(\frac{7Q}{3} - \frac{10Q^3}{3} + \frac{10Q^4}{3} - Q^5\right) \quad 3.195ii$$

Differentiating to fourth order and multiplying with Equation 3.195ii gives;

$$k_1 = \int_0^1\int_0^1 h.\frac{d^4h}{dR^4}.dR\, dQ = \int_0^1\int_0^1 24(1.5R^2 - 2.5R^3 + R^4)\left(\frac{49Q^2}{9} - \frac{140Q^4}{9} + \frac{140Q^5}{9} + \frac{59Q^6}{9} - \frac{200Q^7}{9} + \frac{160Q^8}{9} - \frac{20Q^9}{3} + Q^{10}\right).dR\, dQ \quad 3.195iii$$

$$k_1 = h.\frac{d^4h}{dR^4} = 24.\left[\frac{R^3}{3} - \frac{2R^4}{4} + \frac{R^5}{5}\right]_0^1.\left[\frac{49Q^3}{27} - \frac{140Q^5}{45} + \frac{140Q^6}{54} + \frac{59Q^7}{63} - \frac{200Q^8}{72} + \frac{160Q^9}{81} - \frac{20Q^{10}}{30} + \frac{Q^{11}}{99}\right]_0^1 \quad 3.195iv$$

$$k_1 = h.\frac{d^4h}{dR^4} = 24.\left[\frac{1}{3} - \frac{2}{4} + \frac{1}{5}\right].\left[\frac{49}{27} - \frac{140}{45} + \frac{140}{54} + \frac{59}{63} - \frac{200}{72} + \frac{160}{81} - \frac{20}{30} + \frac{1}{99}\right]$$

$$= 24*0.0333333*0.773769 = 0.6190152 \quad 3.195v$$

Similarly, k_2, k_3, k_4, k_5, k_6, k_7 and k_8 were also calculated.

3.3.2.10 Calculation of the stiffness coefficients of CSFS rectangular plate

Substituting the shape profile of Equation 3.184b into Equations 3.150 to 3.157 and integrating appropriately gives the stiffness coefficients for CSFS rectangular plate as shown in Equations 3.196a, 3.196b, 3.196c, 3.196d, 3.196e, 3.196f, 3.196g and 3.196h

$$k_1 = \int_0^1\int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\,dQ = 0.328478 \quad 3.196a$$

$$k_2 = \int_0^1\int_0^1 \left(\frac{d^2h}{dRdQ}\right)^2 dR\,dQ = 4.99592 \quad 3.196b$$

$$k_3 = \int_0^1\int_0^1 \left(\frac{d^2h}{dQ^2}\right)^2 dR\,dQ = 1.417142 \quad 3.196c$$

$$k_4 = \int_0^1\int_0^1 \left(\frac{d^2h}{dR^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\,dQ = 0 \quad 3.196d$$

$$k_5 = \int_0^1\int_0^1 \left(\frac{d^2h}{dQ^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\,dQ = 0 \quad 3.196e$$

$$k_6 = \int_0^1\int_0^1 \left(\frac{dh}{dR}\right)^2 dR\,dQ = 1.1225397 \quad 3.196f$$

$$k_7 = \int_0^1\int_0^1 \left(\frac{dh}{dQ}\right)^2 dR\,dQ = 0.506122 \quad 3.196g$$

$$k_8 = \int_0^1\int_0^1 h\,dR\,dQ = 0.240000 \quad 3.196h$$

The “k” values can be obtained as follows;

$$k_1 = \int_0^1\int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\,dQ = \int_0^1\int_0^1 h.\frac{d^4h}{dR^4}\,.dR\,dQ \quad 3.196i$$

$$h. = (R-2R^3+R^4)(2.8Q^2 - 5.2Q^3 + 3.8Q^4 - Q^5) \quad 3.196ii$$

Differentiating to fourth order and multiplying with Equation 3.196ii gives;

$$k_1 = \int_0^1\int_0^1 h.\frac{d^4h}{dR^4}\,.dR\,dQ = \int_0^1\int_0^1 24(R - 2R^3 + R^4)\,(7.84Q^4 - 29.12Q^5 + 48.32Q^6 - 45.12Q^7 + 24.84Q^8 - 7.6Q^9 + Q^{10})\,.dR\,dQ \quad 3.196iii$$

$$k_1 = h.\frac{d^4h}{dR^4} = 24.\left[\frac{R^2}{2} - \frac{2R^4}{4} + \frac{R^5}{5}\right]_0^1 . \left[\frac{7.84Q^5}{5} - \frac{29.12Q^6}{6} + \frac{48.32Q^7}{7} - \frac{45.12Q^8}{8} + \frac{24.84Q^9}{9} - \frac{7.6Q^{10}}{10} + \frac{Q^{11}}{11}\right]_0^1 \quad 3.196iv$$

$$k_1 = h.\frac{d^4h}{dR^4} = 24.\left[\frac{1}{3} - \frac{2}{4} + \frac{1}{5}\right].\left[\frac{7.84}{5} - \frac{29.12}{6} + \frac{48.32}{7} - \frac{45.12}{8} + \frac{24.84}{9} - \frac{7.6}{10} + \frac{1}{11}\right]$$

$$= 24*0.2*0.0684329 = 0.328478 \quad 3.196v$$

Similarly, k_2, k_3, k_4, k_5, k_6, $k_7$and k_8 were also calculated.

3.3.2.11 Calculation of the stiffness coefficients of CCFS rectangular plate

Substituting the shape profile of Equation 3.185b into Equations 3.150 to 3.157 and integrating appropriately gives the stiffness coefficients for CSFS rectangular plate as shown in Equations 3.197a, 3.197b, 3.197c, 3.197d, 3.197e, 3.197f, 3.197g and 3.197h

$$k_1 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\, dQ \;= 0.123179 \qquad 3.197a$$

$$k_2 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dRdQ}\right)^2 dR\, dQ = 0.040514 \qquad 3.197b$$

$$k_3 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)^2 dR\, dQ = 0.006047 \qquad 3.197c$$

$$k_4 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ = 0 \qquad 3.197d$$

$$k_5 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dQ^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\, dQ = 0 \qquad 3.197e$$

$$k_6 = \int_0^1 \int_0^1 \left(\frac{dh}{dR}\right)^2 dR\, dQ = 0.0159753 \qquad 3.197f$$

$$k_7 = \int_0^1 \int_0^1 \left(\frac{dh}{dQ}\right)^2 dR\, dQ = 0.0033762 \qquad 3.197g$$

$$k_8 = \int_0^1 \int_0^1 h\, dR\, dQ = 0.0277778 \qquad 3.197h$$

The "k" values can be obtained as follows;

$$k_1 = \int_0^1 \int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\, dQ = \int_0^1 \int_0^1 h.\frac{d^4h}{dR^4}\, .dR\, dQ \qquad 3.197i$$

$$h. = (1.5R^2\text{-}2.5R^3+R^4)(2.8Q^2 - 5.2Q^3 + 3.8Q^4 - Q^5) \qquad 3.197ii$$

Differentiating to fourth order and multiplying with Equation 3.197ii gives;

$$k_1 = \int_0^1 \int_0^1 h.\frac{d^4h}{dR^4}\, .dR\, dQ = \int_0^1 \int_0^1 24(1.5R^2 - 2.5R^3 + R^4)\,(7.84Q^4 - 29.12Q^5 + 48.32Q^6 - 45.12Q^7 + 24.84Q^8 - 7.6Q^9 + Q^{10})\, .dR\, dQ \qquad 3.197iii$$

$$k_1 = h.\frac{d^4h}{dR^4} = 24.[\frac{1.5R^3}{3} - \frac{2.5R^4}{4} + \frac{R^5}{5}]_0^1.[\frac{7.84Q^5}{5} - \frac{29.12Q^6}{6} + \frac{48.32Q^7}{7} - \frac{45.12Q^8}{8} + \frac{24.84Q^9}{9} - \frac{7.6Q^{10}}{10} + \frac{Q^{11}}{11}]_0^1$$

3.197iv

$$k_1 = h.\frac{d^4h}{dR^4} = 24.[\frac{1.5}{3} - \frac{2.5}{4} + \frac{1}{5}].[\frac{7.84}{5} - \frac{29.12}{6} + \frac{48.32}{7} - \frac{45.12}{8} + \frac{24.84}{9} - \frac{7.6}{10} + \frac{1}{11}]$$

$$= 24*0.075*0.0684329 = 0.123179 \quad 3.197v$$

Similarly, k_2, k_3, k_4, k_5, k_6, $k_7$and k_8 were also calculated.

3.3.2.12 Calculation of the stiffness coefficients of SCFC rectangular plate

Substituting the shape profile of Equation 3.186b into Equations 3.150 to 3.157 and integrating appropriately gives the stiffness coefficients for SCFC rectangular plate as shown in Equations 3.198a, 3.198b, 3.198c, 3.198d, 3.198e, 3.198f, 3.198g and 3.198h

$$k_1 = \int_0^1\int_0^1\left(\frac{d^2h}{dR^2}\right)^2 dR\,dQ = 0.6190152 \quad 3.198a$$

$$k_2 = \int_0^1\int_0^1\left(\frac{d^2h}{dRdQ}\right)^2 dR\,dQ = 0.8816327 \quad 3.198b$$

$$k_3 = \int_0^1\int_0^1\left(\frac{d^2h}{dQ^2}\right)^2 dR\,dQ = 0.217985 \quad 3.198c$$

$$k_4 = \int_0^1\int_0^1\left(\frac{d^2h}{dR^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\,dQ = 0.5625 \quad 3.198d$$

$$k_5 = \int_0^1\int_0^1\left(\frac{d^2h}{dQ^2}\right)\left(\frac{d^2h}{dRdQ}\right) dR\,dQ = 0 \quad 3.198e$$

$$k_6 = \int_0^1\int_0^1\left(\frac{dh}{dR}\right)^2 dR\,dQ = 0.198095 \quad 3.198f$$

$$k_7 = \int_0^1\int_0^1\left(\frac{dh}{dQ}\right)^2 dR\,dQ = 0.077531 \quad 3.198g$$

$$k_8 = \int_0^1\int_0^1 h\,dR\,dQ = 0.09000 \quad 3.198h$$

The "k" values can be obtained as follows;

$$k_1 = \int_0^1\int_0^1 \left(\frac{d^2h}{dR^2}\right)^2 dR\,dQ = \int_0^1\int_0^1 h.\frac{d^4h}{dR^4}\,.dR\,dQ \qquad 3.198i$$

$$h. = (R^2 - 2R^3+R^4)(\frac{7Q}{3} - \frac{10Q^3}{3} + \frac{10Q^4}{3} - Q^5) \qquad 3.198ii$$

Differentiating to fourth order and multiplying with Equation 3.198ii gives;

$$k_1 = \int_0^1\int_0^1 h.\frac{d^4h}{dR^4}\,.dR\,dQ = \int_0^1\int_0^1 24(R^2 - 2R^3 + R^4)\,(\frac{49Q^2}{9} - \frac{140Q^4}{9} + \frac{140Q^5}{9} + \frac{59Q^6}{9} - \frac{200Q^7}{9} + \frac{160Q^8}{9} - \frac{20Q^9}{3} + Q^{10})\,.dR\,dQ \qquad 3.198iii$$

$$k_1 = h.\frac{d^4h}{dR^4} = 24.[\frac{R^3}{3} - \frac{2R^4}{4} + \frac{R^5}{5}]_0^1.\,[\frac{49Q^3}{27} - \frac{140Q^5}{45} + \frac{140Q^6}{54} + \frac{59Q^7}{63} - \frac{200Q^8}{72} + \frac{160Q^9}{81} - \frac{20Q^{10}}{30} + \frac{Q^{11}}{99}]_0^1 \qquad 3.198iv$$

$$k_1 = h.\frac{d^4h}{dR^4} = 24.[\frac{1}{3} - \frac{2}{4} + \frac{1}{5}].\,[\frac{49}{27} - \frac{140}{45} + \frac{140}{54} + \frac{59}{63} - \frac{200}{72} + \frac{160}{81} - \frac{20}{30} + \frac{1}{99}]$$

$$= 24*0.03333333*0.773769 = 0.6190152 \qquad 3.198v$$

Similarly, k_2, k_3, k_4, k_5, k_6, k_7 and k_8 were also calculated.

3.4 Development of formulas for determining the displacements and stresses

Substituting Equation 3.169 into Equations 3.139, 3.171 and 3.172 gives the expression of Equation 3.199a

$$w = \left(\frac{k_8}{k_T}\right) h\,.\frac{qa^4}{D_0} \qquad 3.199a$$

Rewriting Equation 3.199a gives Equation 3.199b

$$w = \left(\frac{k_8}{k_T}\right) h\,.\frac{12[1 - \mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \qquad 3.199b$$

Rearranging Equation 3.199b gives Equation 3.199c

$$w\frac{E_0t^3}{qa^4} = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{k_8}{k_T}\right) h = \overline{w} \qquad 3.199c$$

Substituting Equation 3.169 into Equations 3.171 and 3.172 gives the expression of Equations 3.200 and 3.201

$$\text{Ø}_x = \left(\frac{k_8}{k_T}\right) P_2 . \frac{\partial h}{\partial R} . \frac{qa^3}{D_0} \qquad 3.200$$

$$\text{Ø}_y = \left(\frac{k_8}{k_T}\right) \frac{P_3}{\beta} . \frac{\partial h}{\partial Q} \frac{qa^3}{D_0} \qquad 3.201$$

Substituting Equations 3.199a and 3.200 into Equation 3.8a gives the expression of Equation 3.202

$$u = -S\frac{\partial h}{\partial R}\left(\frac{k_8}{k_T}\right) . \frac{tqa^3}{D_0} + \left(S - \frac{4}{3}S^3\right) . \left(\frac{k_8}{k_T}\right) P_2 . \frac{\partial h}{\partial R} . \frac{tqa^3}{D_0} \qquad 3.202a$$

Where $Z = St$ and $F(Z) = Z.\left(1 - \frac{4}{3}[\frac{Z}{t}]^2\right) = t.\left(3 - \frac{4S^3}{3}\right)$ [see equation 3.8a for F(Z)]

That is:

$$u = \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . S . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} . \frac{tqa^3}{D_0} \qquad 3.202b$$

Substituting Equations 3.199a and 3.201 into Equation 3.8b gives the expression of Equation 3.203

$$v = -\frac{S}{\beta}\frac{\partial h}{\partial Q}\left(\frac{k_8}{k_T}\right) . \frac{tqa^3}{D_0} + \left(S - \frac{4}{3}S^3\right) . \left(\frac{k_8}{k_T}\right) \frac{P_3}{\beta} . \frac{\partial h}{\partial Q} \frac{tqa^3}{D_0} \qquad 3.203a$$

That is:

$$v = \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{S}{\beta} . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial Q} . \frac{tqa^3}{D_0} \qquad 3.203b$$

Substituting Equation 3.88 into Equation 3.202 gives the expression of Equation 3.204

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2 \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . S . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} . \frac{qa}{E_0} \qquad 3.204$$

Rearranging Equation 3.204 gives Equation 3.205

$$u\frac{E_0}{qa} . \left(\frac{t}{a}\right)^2 = 12[1 - \mu_{xy}\mu_{yx}] \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . S . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} = \bar{u} \qquad 3.205$$

Substituting Equation 3.88 into Equation 3.203 gives Equation 3.206

$$v = 12\left[1 - \mu_{xy}\mu_{yx}\right]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \qquad 3.206$$

Rearranging Equation 3.206 gives Equation 3.207

$$v\frac{E_0}{qa}.\left(\frac{t}{a}\right)^2 = 12\left[1 - \mu_{xy}\mu_{yx}\right]\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = \bar{v} \qquad 3.207$$

Substituting Equations 3.199a, 3.200 and 3.201 into Equation 3.65 gives the expression of Equation 3.208

$$\begin{aligned}\sigma_R = \frac{E_0 t}{\left[1 - \mu_{xy}\mu_{yx}\right]a^2}.\Bigg(& B_{11}.\left[-S\frac{\partial^2}{\partial R^2}\left(\frac{k_8}{k_T}\right)h.\frac{qa^4}{D_0} + Ha.\frac{\partial}{\partial R}\left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0}\right] \\ &+ \frac{B_{12}}{\beta^2}.\left[-S\frac{\partial^2}{\partial Q^2}\left(\frac{k_8}{k_T}\right)h.\frac{qa^4}{D_0} + Ha\beta.\frac{\partial}{\partial Q}\left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0}\right] \\ &+ \frac{B_{13}}{\beta}.\Bigg[-2S\frac{\partial^2}{\partial R\partial Q}\left(\frac{k_8}{k_T}\right)h.\frac{qa^4}{D_0} \\ &+ Ha.\left(\frac{\partial}{\partial Q}\left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} + \beta.\frac{\partial}{\partial R}\left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0}\right)\Bigg]\Bigg)\end{aligned} \qquad 3.208a$$

That is:

$$\begin{aligned}\sigma_R = \frac{E_0 t}{\left[1 - \mu_{xy}\mu_{yx}\right]}.\frac{qa^2}{D_0}\Bigg(& B_{11}.[-S + HP_2].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.[-S + HP_3].\frac{\partial^2 h}{\partial Q^2} \\ &+ \frac{B_{13}}{\beta}.[-2S + H(P_2 + P_3)].\frac{\partial^2 h}{\partial R\partial Q}\Bigg)\left(\frac{k_8}{k_T}\right)\end{aligned} \qquad 3.208b$$

That is:

$$\begin{aligned}\sigma_R = \frac{E_0 tS}{\left[1 - \mu_{xy}\mu_{yx}\right]}.\left(\frac{k_8}{k_T}\right).\frac{qa^2}{D_0}\Bigg(& B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} \\ &+ \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Bigg)\end{aligned} \qquad 3.208c$$

That is:

$$\sigma_R = \frac{E_0 tS}{[1-\mu_{xy}\mu_{yx}]} \cdot \left(\frac{k_8}{k_T}\right) \cdot \frac{12[1-\mu_{xy}\mu_{yx}]qa^2}{E_0 t^3} \left(B_{11} \cdot \left[P_2 - \frac{4}{3}P_2 S^2 - 1 \right] \cdot \frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2} \cdot \left[P_3 - \frac{4}{3}P_3 S^2 - 1 \right] \cdot \frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta} \cdot \left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2 \right] \cdot \frac{\partial^2 h}{\partial R \partial Q} \right) \qquad 3.208d$$

That is:

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) \cdot \left(B_{11} \cdot \left[P_2 - \frac{4}{3}P_2 S^2 - 1 \right] \cdot \frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2} \cdot \left[P_3 - \frac{4}{3}P_3 S^2 - 1 \right] \cdot \frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta} \cdot \left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2 \right] \cdot \frac{\partial^2 h}{\partial R \partial Q} \right) \qquad 3.208e$$

Rewriting Equation 3.208 gives Equation 3.209

$$\frac{\sigma_R}{q} \cdot \left(\frac{t}{a}\right)^2 = 12S\left(\frac{k_8}{k_T}\right) \cdot \left(B_{11} \cdot \left[P_2 - \frac{4}{3}P_2 S^2 - 1 \right] \cdot \frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2} \cdot \left[P_3 - \frac{4}{3}P_3 S^2 - 1 \right] \cdot \frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta} \cdot \left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2 \right] \cdot \frac{\partial^2 h}{\partial R \partial Q} \right) = \bar{\sigma}_R \qquad 3.209$$

Similarly substituting Equations 3.199a, 3.200 and 3.201 into Equation 3.66 and simplifying gives the expression of Equation 3.210

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) \cdot \left(B_{21} \cdot \left[P_2 - \frac{4}{3}P_2 S^2 - 1 \right] \cdot \frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2} \cdot \left[P_3 - \frac{4}{3}P_3 S^2 - 1 \right] \cdot \frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta} \cdot \left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2 \right] \cdot \frac{\partial^2 h}{\partial R \partial Q} \right) \qquad 3.210$$

Rewriting Equation 3.210 gives Equation 3.211

$$\frac{\sigma_Q}{q} \left(\frac{t}{a}\right)^2 = 12S\left(\frac{k_8}{k_T}\right) \cdot \left(B_{21} \cdot \left[P_2 - \frac{4}{3}P_2 S^2 - 1 \right] \cdot \frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2} \cdot \left[P_3 - \frac{4}{3}P_3 S^2 - 1 \right] \cdot \frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta} \cdot \left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2 \right] \cdot \frac{\partial^2 h}{\partial R \partial Q} \right) = \bar{\sigma}_Q \qquad 3.211$$

Similarly substituting Equations 3.199a, 3.200 and 3.201 into Equation 3.67 and simplifying gives the expression of Equation 3.212

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) \quad 3.212$$

Rewriting Equation 3.212 gives Equation 3.213

$$\frac{\tau_{RQ}}{q}\left(\frac{t}{a}\right)^2 = 12S.\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = \bar{\tau}_{RQ} \quad 3.213$$

Substituting Equation 3.200 into Equation 3.68 gives the expression of Equation 3.214

$$\tau_{RS} = \frac{E_0 t}{[1-\mu_{xy}\mu_{yx}]a^2}.B_{44}.\left[\frac{a^2}{t}.\frac{\partial H}{\partial S}\right].\left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad 3.214$$

Simplifying Equation 3.214 give Equation 3.215

$$\tau_{RS} = \frac{E_0 t}{[1-\mu_{xy}\mu_{yx}]a^2}.B_{44}.\left[\frac{a^2}{t}.(1-4S^2)\right].\left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{12[1-\mu_{xy}\mu_{yx}]qa^3}{E_0 t^3} \quad 3.215$$

Equation 3.215 can further be simplified to obtain Equation 3.216

$$\tau_{RS} = B_{44}(1-4S^2).\left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{12qa^3}{t^3} \quad 3.216$$

From Equation 3.216 we obtain Equation 3.217

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} \quad 3.217$$

Rewriting Equation 3.217 gives the expression of Equation 3.218

$$\frac{\tau_{RS}}{q}\left(\frac{t}{a}\right) = 12\left(\frac{a}{t}\right)^2 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = \bar{\tau}_{RS} \quad 3.218$$

Similarly substituting Equation 3.201 into Equation 3.69 gives the expression of Equation 3.219

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad 3.219$$

Rewriting Equation 3.219 gives the expression of Equation 3.220

$$\frac{\tau_{QS}}{q}\left(\frac{t}{a}\right) = 12\left(\frac{a}{t}\right)^2 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = \bar{\tau}_{QS} \qquad 3.220$$

3.5 Numerical analyses of typical thick anisotropic rectangular plates with different boundary conditions

The numerical values for typical thick anisotropic rectangular plate in-plane displacements (u and v), out-plane displacement - central deflection (w), in-plane stresses (σ_x, σ_y and τ_{xy}), and out-plane stresses (τ_{xz} and τ_{yz}) were determined for angles fiber orientations of 0^0, 15^0, 30^0, 45^0, 60^0, 75^0 and 90^0 at span to thickness ration (α) of 5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 for the twelve boundary conditions considered in this work. The materials were analyzed for in-plane displacement (u,v) at x = 0.5, y = 0.5, z = 0; transverse displacement (w) at x = 0.5, y = 0.5, z = 0); in-plane normal stresses (σ_x, σ_y) at x = 0.5, y = 0.5, z = 0.5 or z = 0.25; in-plane shear stress (τ_{xy}) at x = 0, y = 0, z = 0.5; out-plane shear stress (τ_{xz}) at x = 0, y = 0.5, z = 0 and out-plane shear stress (τ_{yz}) at x = 0.5, y = 0, z = 0. The plate was subjected to uniformly distributed load.

The material properties used are as follows: $E_1/E_2 = 25$, $G_{12}/E_2 = 0.5$, $G_{13}/E_2 = 0.5$, $G_{23}/E_2 = 0.2$, $v_{12} = 0.25$. The plate parameters employed here are similar to the one employed by Atashipour *et al.* (2017) The following non-dimensionalizations they applied were also used in this work:

$$\bar{w} = w\frac{E_0 t^3}{qa^4}x100,\ \bar{u},\bar{v} = u,v\frac{E_0 t^2}{qa^3},\ (\overline{\sigma_{xx}}, \overline{\sigma_{yy}}, \overline{\tau_{xy}}) = (\frac{\sigma_x,\sigma_y,\tau_{xy}t^2}{qa^2}),\ (\overline{\tau_{xz}}, \overline{\tau_{yz}}) = (\frac{\tau_{xz},\tau_{yz}t}{qa}).$$

3.5.1 Example problem of SSSS thick anisotropic rectangular plate

Analyze an anisotropic thick square SSSS plate with the following information:

$E_1 = 25$; $E_2 = 1$; $G_{12} = 0.5$; $G_{13} = 0.5$; $G_{23} = 0.2$, $\mu_{12} = 0.25$.

Solution

$$h = (R - 2R^3 + R^4)(Q - 2Q^3 + Q^4) \qquad 3.221$$

$$H = S - \frac{4}{3}S^3 \qquad 3.222$$

$$E_0 = E_2 = 1 \qquad 3.223$$

$g_2 = \frac{4}{5}$; $g_3 = \frac{68}{105}$; $g_4 = 6.4$; $\mu_{21} = \mu_2 = \frac{E_2}{E_1}\mu_{12} = 0.01$; 3.224

$$E_{11} = E_1 \ and \ d_{11} = \frac{E_{11}}{E_0} = \frac{E_{11}}{1} = 25 \quad 3.225$$

$$E_{12} = E_2 \, . \mu_{12} \ and \ d_{12} = \frac{E_{12}}{E_0} = \frac{E_2 \, . \mu_{12}}{1} = \frac{1 \times 0.25}{1} = 0.25 \quad 3.226$$

$$E_{21} = E_1 \, . \mu_{21} \ and \ d_{21} = \frac{E_{21}}{E_0} = \frac{E_1 \, . \mu_{21}}{1} = \frac{25 \times 0.01}{E_0} = 0.25 \quad 3.227$$

$$E_{22} = E_2 \ and \ d_{22} = \frac{E_{22}}{E_0} = \frac{1}{1} = 1 \quad 3.228$$

$$E_{33} = G_{12}(1 - \mu_{12}\mu_{21}) \ and \ d_{33} = \frac{E_{33}}{E_0} = \frac{G_{12}(1-\mu_{12}\mu_{21})}{1} = \frac{0.5 \times (1 - 0.25 \times 0.01)}{1} = 0.49875 \quad 3.229$$

$$E_{44} = G_{13}(1 - \mu_{12}\mu_{21}) \ and \ d_{44} = \frac{E_{44}}{E_0} = \frac{G_{13}(1-\mu_{12}\mu_{21})}{1} = \frac{0.5 \times (1 - 0.25 \times 0.01)}{1} = 0.49875 \quad 3.230$$

$$E_{55} = G_{23}(1 - \mu_{12}\mu_{21}) \ and \ d_{55} = \frac{E_{55}}{E_0} = \frac{G_{23}(1-\mu_{12}\mu_{21})}{1} = \frac{0.2 \times (1 - 0.25 \times 0.01)}{1} = 0.1995 \quad 3.231$$

Constitutive relations

$$B_{11} = m^4 d_{11} + 2m^2 n^2 (d_{12} + 2d_{33}) + n^4 d_{22} \quad 3.232$$

$$B_{12} = d_{12}(n^4 + m^4) + m^2 n^2 (d_{11} + d_{22} - 4d_{33}) \quad 3.233$$

$$B_{13} = m^3 n (d_{11} - d_{12} - 2d_{33}) + mn^3 (d_{12} - d_{22} + 2d_{33}) \quad 3.234$$

$$B_{22} = n^4 d_{11} + 2m^2 n^2 (d_{12} + 2d_{33}) + m^4 d_{22} \quad 3.235$$

$$B_{23} = mn^3 d_{11} - m^3 n d_{22} + (m^3 n - mn^3)(d_{12} + 2d_{33}) \quad 3.236$$

$$B_{33} = m^2 n^2 (d_{11} - 2d_{12} + d_{22} - 2d_{33}) + d_{33}(m^4 + n^4) \quad 3.237$$

$$B_{21} = B_{12}, \quad B_{31} = B_{13} \ and \ B_{32} = B_{23}$$

$$B_{44} = d_{44} \quad 3.238$$

$$B_{55} = d_{55} \quad 3.239$$

$k_1 = 0.236190476$; $k_2 = 0.235918$; $k_3 = 0.236190476$; $k_4 = 0$; $k_5 = 0$;
$k_6 = 0.0239$; $k_7 = 0.0239$ 3.240

$k_8 = 0.04$

For square plate, β = 1, a/t = 100

$$P_2 = \frac{(L_{12}.L_{23} - L_{13}.L_{22})}{\left(L_{12}{}^2 - L_{11}L_{22}\right)} \quad 3.241$$

$$P_3 = \frac{(L_{12}.L_{13} - L_{11}L_{23})}{\left(L_{12}{}^2 - L_{11}L_{22}\right)} \quad 3.242$$

$$L_{11} = g_3 B_{11} k_1 + \frac{B_{33}}{\beta^2} g_3 k_2 + 2\frac{B_{13}}{\beta} g_3 k_4 + B_{44}.\left(\frac{a}{t}\right)^2 . g_4 . k_6 \quad 3.243$$

$$L_{12} = (B_{12} + B_{33})\frac{g_3}{\beta^2} k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 \quad 3.244$$

$$L_{13} = (B_{11} + 0.5B_{12}) g_2 k_1 + (0.5B_{12} + B_{33})\frac{g_2}{\beta^2} k_2 + 3\frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 \quad 3.245$$

$$L_{21} = (B_{12} + B_{33})\frac{g_3}{\beta^2} . k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 \quad 3.246$$

$$L_{22} = \frac{B_{22}}{\beta^4} g_3 k_3 + 2\frac{B_{23}}{\beta^3} g_3 k_5 + \frac{B_{33}}{\beta^2} g_3 k_2 + \frac{B_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2 . g_4 k_7 \quad 3.247$$

$$L_{23} = (0.5B_{12} + B_{33})\frac{g_2}{\beta^2} k_2 + (0.5B_{12} + B_{22})\frac{g_2}{\beta^4} k_3 + \frac{B_{13}}{\beta} g_2 k_4 + 3\frac{B_{23}}{\beta^3} g_2 k_5 \quad 3.248$$

The complete solution to this problem is shown in the appendix.

3.5.2 Example problem of CCCC thick anisotropic rectangular plate

Analyze an anisotropic thick square CCCC plate with the following information:
$E_1 = 25$; $E_2 = 1$; $G_{12} = 0.5$; $G_{13} = 0.5$; $G_{23} = 0.2$, $\mu_{12} = 0.25$.
Solution

$$h = (R^2 - 2R^3 + R^4)(Q^3 - 2Q^3 + Q^4) \quad 3.249$$

$$H = S - \frac{4}{3}S^3 \quad 3.250$$

$$E_0 = E_2 = 1 \quad 3.251$$

$$g_2 = \frac{4}{5};\ g_3 = \frac{68}{105}; g_4 = 6.4;\quad \mu_{21} = \mu_2 = \frac{E_2}{E_1}\mu_{12} = 0.01; \quad 3.252$$

$$E_{11} = E_1 \ and\ d_{11} = \frac{E_{11}}{E_0} = \frac{E_{11}}{1} = 25 \quad 3.253$$

$$E_{12} = E_2 . \mu_{12} \ and\ d_{12} = \frac{E_{12}}{E_0} = \frac{E_2 . \mu_{12}}{1} = \frac{1 \times 0.25}{1} = 0.25 \quad 3.254$$

$E_{21} = E_1 \,.\, \mu_{21} \; and \; d_{21} = \frac{E_{21}}{E_0} = \frac{E_1 \,.\mu_{21}}{1} = \frac{25 \times 0.01}{E_0} = 0.25$ 3.255

$E_{22} = E_2 \;\; and \; d_{22} = \frac{E_{22}}{E_0} = \frac{1}{1} = 1$ 3.256

$E_{33} = G_{12}(1 - \mu_{12}\mu_{21}) \quad and \; d_{33} = \frac{E_{33}}{E_0} = \frac{G_{12}(1-\mu_{12}\mu_{21})}{1} = \frac{0.5\times(1-0.25\times0.01)}{1} = 0.49875$
3.257

$E_{44} = G_{13}(1 - \mu_{12}\mu_{21}) \quad and \; d_{44} = \frac{E_{44}}{E_0} = \frac{G_{13}(1-\mu_{12}\mu_{21})}{1} = \frac{0.5\times(1-0.25\times0.01)}{1} = 0.49875$
3.258

$E_{55} = G_{23}(1 - \mu_{12}\mu_{21}) \; and \; d_{55} = \frac{E_{55}}{E_0} = \frac{G_{23}(1-\mu_{12}\mu_{21})}{1} = \frac{0.2\times(1-0.25\times0.01)}{1} = 0.1995$
3.259

Constitutive relations

Angle of orientation $\theta = \mathbf{0^o}$
Just like Equations 3.250 – 3.259 evaluate 3.260 – 3.268 as shown;

$B_{11} = m^4 d_{11} + 2m^2n^2(d_{12} + 2d_{33}) + n^4 d_{22} \;\; = \quad 25$ 3.260

= 1*25 + 2*1*0*(0.25 + 2*0.49875) +0^4*1 = 25 3.260a

$B_{12} = d_{12}(n^4 + m^4) + m^2n^2(d_{11} + d_{22} - 4d_{33}) \quad = \quad 0.25$ 3.261

= 0.25*(0^4 + 1^4) + 1^2*0^2*(25 + 1 – 4*0.49875) 0.25 3.61a

$B_{13} = m^3n(d_{11} - d_{12} - 2d_{33}) + mn^3(d_{12} - d_{22} + 2d_{33}) \; = \; 0$ 3.262

= 1^3*0*(25 – 0.25 – 2*0.49875) + 1*0^3*(0.25 – 1 + 2*0.49875) = 0 3.262a

$B_{22} = n^4 d_{11} + 2m^2n^2(d_{12} + 2d_{33}) + m^4 d_{22} \;\; = \; 1$ 3.263

= 0^4*25 + 2*1^2*0^2*(0.25 +2*0.49875) + 1^4*1 = 1 3.262a

$B_{23} = mn^3 d_{11} - m^3 n d_{22} + (m^3 n - mn^3)(d_{12} + 2d_{33}) \;\; = 0$ 3.264

= 1*0^3*25 – 1^3*0*1 + (1^3*0 – 1*0^3)(0.25 + 2*0.49875) = 0 3.264a

$B_{33} = m^2n^2(d_{11} - 2d_{12} + d_{22} - 2d_{33}) + d_{33}(m^4 + n^4) \;\; = 0.49875$ 3.265

= 1^2*0^2*(25 -2*0.25 + 1 – 2*0.49875) + 0.49875*(1^4 + 0^4) = 0.49875 3.265a

$B_{21} = B_{12},\ B_{31} = B_{13}\ \ and\ \ B_{32} = B_{23}$ 3.266

$B_{44} = d_{44} = \frac{E_{44}}{E_0} = \frac{G_{13}(1-\mu_{12}\mu_{21})}{1} = \frac{0.5\times(1-0.25\times0.01)}{1} = 0.49875$ 3.267

$B_{55} = d_{55} = \frac{E_{55}}{E_0} = \frac{G_{23}(1-\mu_{12}\mu_{21})}{1} = \frac{0.2\times(1-0.25\times0.01)}{1} = 0.1995$ 3.268

$k_1 = 0.00126; k_2 = 0.00036;\ k_3 = 0.00127; k_4 = 0; k_5 = 0; k_6 = 0.00003; k_7 = 0.00003, k_8 = 0.00111$

3.269

For square plate, β = 1, a/t = 5, θ = 0^o

$L_{11} = g_3 \mathrm{B}_{11} k_1 + \frac{\mathrm{B}_{33}}{\beta^2} g_3 k_2 + 2\frac{B_{13}}{\beta} g_3 k_4 + \mathrm{B}_{44}.\left(\frac{a}{t}\right)^2 . g_4 . k_6 = 0.023089221$ 3.270

$L_{12} = (\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_3}{\beta^2} k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 = 0.000175929$ 3.271

$L_{13} = (\mathrm{B}_{11} + 0.5\mathrm{B}_{12}) g_2 k_1 + (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2} k_2 + 3\frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 = 0.02570485$

3.272

$L_{21} = (\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_3}{\beta^2}. k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 = 0.000175929$

3.273

$L_{22} = \frac{\mathrm{B}_{22}}{\beta^4} g_3 k_3 + 2\frac{B_{23}}{\beta^3} g_3 k_5 + \frac{\mathrm{B}_{33}}{\beta^2} g_3 k_2 + \frac{\mathrm{B}_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2 . g_4 k_7 = 0.001904641$ 3.274

$L_{23} = (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2} k_2 + (0.5\mathrm{B}_{12} + \mathrm{B}_{22})\frac{g_2}{\beta^4} k_3 + \frac{B_{13}}{\beta} g_2 k_4 + 3\frac{B_{23}}{\beta^3} g_2 k_5 = 0.0013239$

3.275

$L_{31} = (\mathrm{B}_{11} + 0.5\mathrm{B}_{12}) g_2 k_1 + (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2} k_2 + 3\frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 = 0.02570485$

3.276

$L_{32} = (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2} k_2 + (0.5\mathrm{B}_{12} + \mathrm{B}_{22})\frac{g_2}{\beta^4} k_3 + \frac{B_{13}}{\beta} g_2 k_4 + 3\frac{B_{23}}{\beta^3} g_2 k_5 = 0.0013239$

3.277

$\mathrm{P}_2 = \frac{(L_{12}.L_{23} - L_{13}.L_{22})}{({L_{12}}^2 - L_{11}L_{22})} = 1.108767725$ 3.278

$\mathrm{P}_3 = \frac{(L_{12}.L_{13} - L_{11}L_{23})}{({L_{12}}^2 - L_{11}L_{22})} = 0.592676345$

3.279

$$k_{T1} = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 \quad = 0.003446056 \qquad 3.280$$

$$k_{T2} = \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 = 0.000597181 \qquad 3.281$$

$$k_{T3} = \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 \quad = 0.000592497 \qquad 3.282$$

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 \quad = \quad 0 \qquad 3.283$$

$$k_{T5} = \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 \quad = \quad 0 \qquad 3.284$$

$$k_T = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 + \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 + \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 + \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 = k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = \quad 0.004635733 \qquad 3.285$$

The complete solution to this problem is in the appendix.

3.6 Formulation of the excel worksheet program

Thick anisotropic rectangular plates that are simply supported on all edges (SSSS) and clamped on all edges (CCCC) with aspect ratio of one(1) were analyzed manually for easy understanding of the method. From the manual solution, excel worksheet program was developed to enhance the speed and accuracy of the work. The excel worksheet program was developed following the steps listed (step1 to step13). The program is user friendly and only requires the user to input the correct data for the particular boundary condition in question. It analyzes anisotropic rectangular thick plate of the twelve boundary conditions considered in this work when supplied with the required data. The solution can also analyze thick isotropic plate for the twelve boundary conditions considered; thus, isotropic plates have the same properties in all directions, that is $E_1 = E_2 = E$, $G_{12} = G_{13} = G_{23} = G$ and $\mu_{12} = \mu_{12} = \mu$. These steps formulated are applicable to all the plate twelve boundary conditions. However, some of the steps like step1, step2, step6, step7, step8 and step10 varies in the input with respect to aspect ratio, span to thickness ratio, angle fiber orientation, displacement functions, given data and particular boundary condition in question. Hence what the program requires are input of data that matches the boundary conditions of the particular plate to be solved as illustrated.

Given the following data of a thick anisotropic plate to analyze.

$E_1 = 25$; $E_2 = 1$; $G_{12} = 0.5$; $G_{13} = 0.5$; $G_{23} = 0.2$, $\mu_{12} = 0.25$

STEP1: Select the particular shape profile or shape function that matches the plate boundary condition to be analyzed from the following equations (3.174a, 3.175a, 3.176a, 3.177a, 3.178a, 3.179a, 3.181a, 3.182a, 3.183a, 3.184a, 3.185a and 3.186a).

STEP2: Input the given data (E_1 = 25; E_2 = 1; G_{12} = 0.5; G_{13} = 0.5; G_{23} = 0.2, μ_{12} = 0.25) in the excel worksheet and label boxes appropriately.

STEP3: Using Hooks law and the given data, create boxes in the excel worksheet for calculations of (μ_{21}), (E_{12}), (μ_{12*} μ_{21}), (1 - (μ_{12*} μ_{21}) and (E_0 = (E_2) as shown in equations (3.224) and (3.226).

STEP4: Create boxes in the excel worksheet for the calculations of E_{11}, E_{12}, E_{21}, E_{22}, E_{33}, E_{44}, E_{55} and d_{11}, d_{12}, d_{21}, d_{22}, d_{33}, d_{44}, d_{55} as shown in equations (3.43) to (3.49) respectively.

STEP5: Create boxes in the excel worksheet to calculate the values of g_2, $g_{3,}$ and g_4 from equations (3.82), (3.83) and (3.84). These equations contains various closed integral of shear deformation adopted in the solution.

STEP6: Create boxes in the excel worksheet to calculate the values of stiffness coefficient k_1, k_2, $\mathrm{k}_{3,}$ k_4, k_5, k_6, k_7 and k_8 as shown in equations (3.150) to (3.157) with respect to the shape function "h" of the particular plate boundary condition intended to solve.

STEP7: Create boxes in the excel worksheet for aspect ratio β = b/a (width/length of the rectangular plate) and Alpha (α) = w/t(span/thickness ration) of the plate. The aspect ratio 'β' used here is one (1) but the solution can solve for other aspect ratios like β =1.1, 1.2, 1.3, 2.0, 2.5, 3.0, 3.6, etc. For manual solution, simply substitute the required aspect ratio value at the places aspect ratio were used in the displacements and stresses formulas. The program was designed to accept any aspect ratio of choice.

STEP8: Create boxes in the excel worksheet to input angle in degree which the program converts to radian and also use it to calculate the values of 'm' and 'n' in accordance with equations (3.25).

STEP9: Create boxes in the excel worksheet for calculations of B_{11}, B_{12}, B_{13}, B_{21}, B_{22}, B_{23}, B_{31}, B_{32}, B_{33}, B_{44} and B_{55} as shown in equations (3.51) to (3.59).

STEP10: Create boxes in the excel worksheet for the calculations of the exact displacements functions for the various boundary conditions at a chosen point on the rectangular plate as given in equations (3.174) to (3.186).

STEP11: Create boxes in the excel worksheet for the calculation of L_{11}, L_{12}, L_{13}, L_{21}, L_{22}, L_{23}, P_2, P_3 and K_T as given in equations (3.160) to (3.170). Note that 'L' values will be different for each boundary condition because of the difference in the stiffness coefficients.

STEP12: Create boxes in the excel worksheet which uses the values obtained from step1 to step11 for the calculations of the non-dimensional displacements ($\overline{\mathrm{w}}$, $\overline{\mathrm{u}}$ and $\overline{\mathrm{v}}$) as given in equations (3.199c), (3.205) and (3.207) respectively. The displacement functions should correspond with the particular shape function chosen.

STEP13: Create boxes in the excel worksheet which uses the values obtained from step1 to step11 for the calculations of the non-dimensional stresses ($\overline{\sigma}_{\mathrm{R}}$, $\overline{\sigma}_{\mathrm{Q}}$, $\overline{\tau}_{\mathrm{RQ}}$, $\overline{\tau}_{\mathrm{RS}}$ and $\overline{\tau}_{\mathrm{QS}}$) with regard to equations (3.209), (3.211), (3.213), (3.218) and (3.220). The displacement functions should correspond with the particular shape function chosen.

Figure 6 shows the interface of the excel worksheet program used. The variable data which are stiffness coefficients (k values), aspect ratio of the rectangle (β = b/a), span to thickness ratio α (w/t), angles in degrees (θ) and displacement functions were changed as required by the formulas and the boundary conditions.

E1	E2	G12	G13	G23	V12	V21	E12	V12. V21	1 - V12. V21	E0 = E2	hmax
25	1	0.5	0.5	0.2	0.25	0.01	0.25	0.0025	0.9975	1	0.097656

E11	E12	E21	E22	E33	E44	E55	d11	d12 = d21	d22	d33	d44	d55
25	0.25	0.25	1	0.49875	0.49875	0.1995	25	0.25	1	0.49875	0.49875	0.1995

g2	g3	g4	k1	k2	k3	k4	k5	k6	k7	k8	β = b/a	Alpha
0.8	0.647619048	6.4	0.001269841	0.000362812	0.001269841	0	0	3.02343E-05	3.02343E-05	0.001111111	1	100

Angle			
Degree	Radian	m	n
90	1.570796327	6.12574E-17	1

B11	B12	B13	B22	B23	B33	B44	B55
1	0.25	1.51612E-17	25	1.45502E-15	0.49875	0.49875	0.1995

h1 = h	h'x = dh/dR	h'y = dh/dQ	h"xy = d2h/dRdQ	h"x = d2h/dR2	h"y = d2h/dQ2		h"xy = d2h/dRdQ	h"xy = d2h/dRdQ	h"x = d2h/dR2	h"y = d2h/dQ2
h1(0.5, 0.5)	h2(0.5, 0.5)	h3(0.5, 0.5)	h"xy(0, 0)	h"x(0.5, 0.5)	h"y(0.5, 0.5)	F(z=0)'	h"xy(0.5, 0.5)	h"xy(1,1)	h"x(1, 1)	h"y(1, 1)
0.00390625	0	0	0	-0.0625	-0.0625	1.5	0	0	0	0

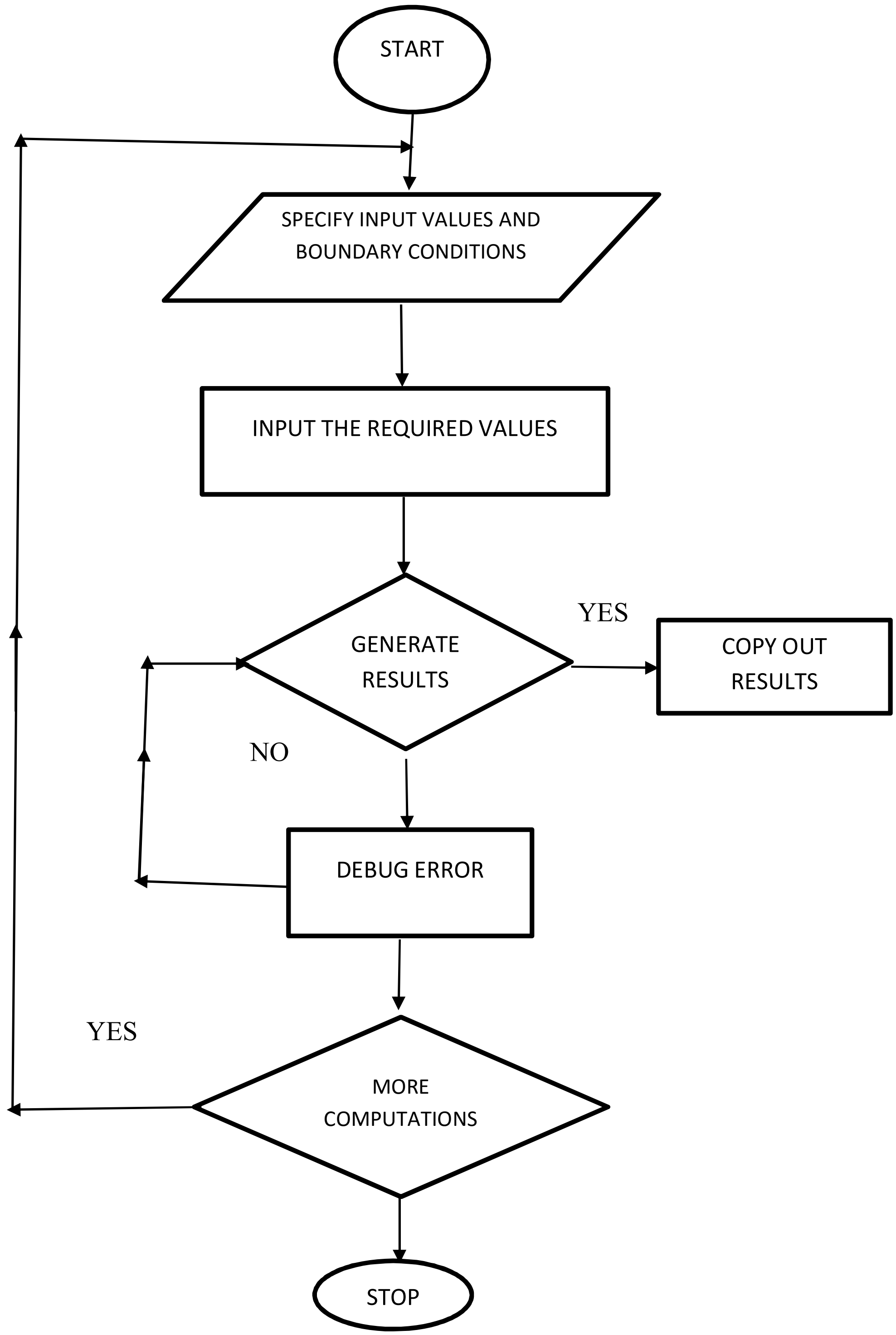
L11	L12	L13	L21 = L12	L22	L23	P2	P3	KT1	KT2	KT3	KT4	KT5
0.966018928	0.000175929	0.0013239	0.000175929	0.406708269	0.025704853	0.00135896	0.0632016	0.001268288	0.000893527	0.030132886	0	0

KT	K8/KT	wmax	ϕx	ϕy	u	v	σR	σQ	τRQ	τRS	τQS
0.032294701	0.034405369	0.000134396	0	0	0	0	159.7992304	3121.824477	0	0	0

$\hat{w}max$	$\bar{\sigma}_R$	$\bar{\sigma}_Q$	$\bar{\tau}_{RQ}$	$\bar{\tau}_{RS}$	$\bar{\tau}_{QS}$
0.00160872	0.015979923	0.312182448	0	0	0

Figure 3.2 Interface showing the excel worksheet program used for anisotropic rectangular thick plate analysis

3.6.1 Flow chart



3.7 Numerical problems comparisons

In order to ensure the validity of the proposed model for the analysis of thick rectangular/square anisotropic plate through exact approach using third order shear deformation theory. The plate considered was simply supported in all edges (SSSS) with 0^oangle fiber orientation. The results were compared with existing results presented in the literature. The validity of the present study is examined by comparing the results with Reddy (1984) higher order shear deformation theory (HSDT), Atashipour *et al.* (2017) first order shear deformation theory (FSDT), Shimpi and Patel (2006) two variable refined plate theory (TVRPT), Srinivas et al. (1970) exact theory (ET) and Reissner (1945) first order shear deformation plate theory (FSDT).

The displacements and stresses were derived here in the form; $\overline{w} = w\frac{E_0 t^3}{qa^4}$, $\overline{\sigma_{xx}} = (\frac{\sigma_x t^2}{qa^2})$, $\overline{\sigma_{yy}} = (\frac{\sigma_y t^2}{qa^2})$, $\overline{\tau_{xz}} = (\frac{\tau_{xz} t}{qa})$, The representations were similar with that of Atashipour *et al.* (2017). Shimpi and Patel (2006), Reddy (1984), Reissner (1945) and Srinivas (1970) derived theirs in the form: $\overline{w} = w\frac{Q_{11}}{qt}$, $\overline{\sigma_{xx}} = (\frac{\sigma_x}{q})$, $\overline{\sigma_{yy}} = (\frac{\sigma_y}{q})$, $\overline{\tau_{xz}} = (\frac{\tau_{xz}}{q})$. Further arithmetic conversions were carried out for the solution values representation to correspond with those of Shimpi and Patel, Reddy, Reissner and Srinivas as presented in Table 3.1. The plate considered was a rectangular anisotropic plate of length ‘a’ width ‘b’ and thickness ‘t’.

The plate was analyzed at various meaningful points along the length, width and depth axis. For SSSS, CCFS, CCSS, CSFS, CSSS, SCFS and SSFS plates: in-plane displacements, u and v, were analyzed at coordinates $(x = 0.5, y = 0.5, z = 0.5)$; transverse displacement, w, was analyzed at coordinate $(x = 0.5, y = 0.5, z = 0.5)$, In-plane normal stresses, σ_x and σ_y, were analyzed at coordinates $(x = 0.5, y = 0.5, z = 0.5)$, in-plane shear stress, τ_{xy}, were analyzed at coordinates $(x = 0, y = 0, z = 0.5)$, out-plane shear stresses, τ_{xz} and τ_{yz}, were analyzed at coordinates $(x = 0, y = 0.5, z = 0.5)$ and $(x = 0.5, y = 0, z = 0.5)$ respectively. For CCCC, CSCS, CCCS, CCFC, SCFC plates: in-plane displacements, u, was analyzed at coordinate $(x = 0.2, y = 0.5, z = 0.5)$; in-plane displacement, v, was analyzed at coordinate $(x = 0.5, y = 0.2, z = 0.5)$; transverse displacement, w, was analyzed at coordinate $(x = 0.5, y = 0.5, z = 0.5)$; In-plane normal stresses, σ_{xx}, σ_{yy} and in-plane shear stress, τ_{xy}, were analyzed at coordinates $(x = 0.2, y = 0.2, z = 0.5)$; while out-plane shear stresses, τ_{xz} and τ_{yz}, were analyzed at coordinates $(x = 0.2, y = 0.5, z = 0.5)$ and $(x = 0.5, y = 0.2, z = 0.5)$ respectively. The plate is subjected to uniformly distributed transverse load.

The plate was subjected to meaningful boundary conditions as shown and it has the following material properties: elastic moduli (E_1, E_2), shear moduli (G_{12}, G_{23}, G_{31}) and poison ratios (μ_{12}, μ_{21}). The subscripts 1, 2 and 3 agrees to x, y, z directions of Cartesian co-ordinate system. This notations were also used by the above listed authors in their analysis.

Table 3.1: Conversion of present study formulas to correspond with Shimpi and Patel (2006), Reddy (1984) and Reissner (1945) formulas.

Present study conversion to correspond with Shimpi and Patel, etc representations	Shimpi and patel, Reddy and Reissner representations
$\overline{w} = w\frac{E_0 t^3}{q a^4} = w\frac{E_0}{qt(1-u_{12}u_{21})} * \frac{t^4(1-u_{12}u_{21})}{a^4}$ Multiplying both sides by $\left[\frac{a}{t}\right]^4 * \frac{1}{(1-u_{12}u_{21})}$ gives: $\left[\frac{a}{t}\right]^4 * \frac{1}{(1-u_{12}u_{21})} * \overline{w} = w\frac{E_0}{qt(1-u_{12}u_{21})}$ Where $\left[\frac{a}{t}\right]^4 = \alpha^4$ i.e. the present solution for $\overline{w}$ will be multiplied by $\left[\frac{a}{t}\right]^4 * \frac{1}{(1-u_{12}u_{21})}$. For isotropic plate, $\overline{w} = w\frac{E_0 t^3}{q a^4} = w\frac{E_0}{2qt(1+\mu)} * \frac{2t^4(1+\mu)}{a^4}$ Multiplying both sides by $\left[\frac{a}{t}\right]^4 * \frac{1}{(1+\mu)}$ gives: $\left[\frac{a}{t}\right]^4 * \frac{1}{2(1+\mu)} * \overline{w} = w\frac{E_0}{2qt(1+\mu)}$	$\overline{w} = w\frac{Q_{11}}{qt}$ Where $Q_{11} = \frac{12 * D_{11}}{t^2} = \frac{E_0}{(1-u_{12}u_{21})}$ That is; $Q_{11} = \frac{E_0}{(1-u_{12}u_{21})}$ Therefore; $\overline{w} = w * \frac{E_0}{qt*(1-u_{12}u_{21})}$ For isotropic plate, $\overline{w} = w\frac{G}{qt} = w\frac{E_0}{2qt(1+\mu)}$

Table 3.1: Continued

$\overline{\sigma_{xx}} = (\frac{\sigma_x t^2}{q a^2}) = (\frac{\sigma_x}{q}) * \left[\frac{t}{a}\right]^2$ For the present formula to match Shimpi and Patel, Reddy, Reissner, Srinivas and Rao formula, both sides will be multiplied by $\left[\frac{a}{t}\right]^2$. That is: $\left[\frac{a}{t}\right]^4 * \overline{\sigma_{xx}} = (\frac{\sigma_x}{q})$ as used by other authors.	$\overline{\sigma_{xx}} = (\frac{\sigma_x}{q})$
$\overline{\sigma_{yy}} = (\frac{\sigma_y t^2}{q a^2}) = (\frac{\sigma_y}{q}) * \left[\frac{t}{a}\right]^2$ For the present formula to match Shimpi and Patel, Reddy, Reissner, Srinivas and Rao formulas, both sides will be multiplied by $\left[\frac{a}{t}\right]^2$. That is: $\left[\frac{a}{t}\right]^4 * \overline{\sigma_{yy}} = (\frac{\sigma_y}{q})$ as used by other authors.	$\overline{\sigma_{yy}} = (\frac{\sigma_y}{q})$
$\overline{\tau_{xz}} = (\frac{\tau_{xz} t}{q a}) = (\frac{\tau_{xz}}{q}) * \left[\frac{t}{a}\right]$ For the present formula to match Shimpi and Patel, Reddy, Reissner, Srinivas and Rao formulas, both sides will be multiplied by $\left[\frac{t}{a}\right]$That is: $\left[\frac{t}{a}\right] * \overline{\tau_{xz}} = (\frac{\tau_{xz}}{q})$ as used by other authors.	$\overline{\tau_{xz}} = (\frac{\tau_{xz}}{q})$

Table 3.1: Continued

$\beta = \frac{b}{a}$, to make it similar to other authors equation, invert both sides of the equation. That is: $\frac{1}{\beta} = \frac{a}{b}$, For example, if β = 0.5 for other authors; here $\frac{1}{\beta} = \frac{1}{0.5}$ = 2.0. If β = 1.0 for other authors; here $\frac{1}{\beta} = \frac{1}{1}$ = 1.0 If β = 2.0 for other authors; here $\frac{1}{\beta} = \frac{1}{2}$ = 0.5 Therefore, for efficient use of the formula, when β = 0.5 convert to 2.0 when β = 1.0 convert to 1.0 when β = 2.0 convert to 0.5	$\beta = \frac{a}{b}$ For example, β = 0.5
$\alpha = \frac{a}{t}$, to make it similar to other authors equation, invert both sides of the equation. That is: $\frac{1}{\alpha} = \frac{t}{a}$, For example, if α = 0.05 for other authors; here $\frac{1}{\alpha} = \frac{1}{0.05}$ = 20.0 If α = 0.1 for other authors; here $\frac{1}{\alpha} = \frac{1}{0.1}$ = 10.0 If α = 0.14 for other authors; here $\frac{1}{\alpha} = \frac{1}{0.14}$ = 7.14286 Therefore, for efficient use of the formula, when α = 0.05 convert to 20.0 when α = 0.1 convert to 10.0 when β = 0.14 convert to 7.14286	$\alpha = \frac{t}{a}$ For example, α = 0.05

Question: Analyze a rectangular orthotropic plate with the following given data E_2/E_1 = 0.52500, G_{12}/E_1 = 0.26293, G_{13}/E_1 = 0.15991, G_{23}/E_1 = 0.26681, μ_{12} = 0.44046, μ_{21} = 0.23124, $(1 - u_{12}u_{21})$ = 0.89815. [Taken from Shimpi and Patel (2006)].

CHAPTER FOUR

Results and Discussion

4.1 Presentation of Results

4.1.1 Total potential energy functional for a thick anisotropic rectangular plate

The total potential energy functional for a thick anisotropic rectangular plate was derived in Equation (3.91) and is as shown in Equation (4.1):

$$\Pi = \frac{abD_0}{2a^4}.\int_0^1\int_0^1\Bigg\{\Bigg\{B_{11}.\left[\left(\frac{\partial^2 w}{\partial R^2}\right)^2 - 2g_2 a.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} + g_3 a^2.\left(\frac{\partial \phi_x}{\partial R}\right)^2\right]$$

$$+\frac{B_{12}}{\beta^2}.\left[2\left(\frac{\partial^2 w}{\partial R\,\partial Q}\right)^2 - g_2\frac{a}{\beta}\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} - g_2 a\beta^2\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_x}{\partial R} - g_2 a.\frac{\partial \phi_x}{\partial R}.\frac{\partial^2 w}{\partial Q^2}\right.$$

$$\left.- g_2 a\beta.\frac{\partial^2 w}{\partial R^2}.\frac{\partial \phi_y}{\partial Q} + 2g_3 a^2\beta.\frac{\partial \phi_x}{\partial R}.\frac{\partial \phi_y}{\partial Q}\right]$$

$$+\frac{B_{13}}{\beta}.\left[4\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial R^2} - 2g_2 a.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial R^2} - 4g_2 a\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial R}\right.$$

$$\left.+ 2g_3 a^2.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_x}{\partial R}\right]$$

$$+\frac{B_{22}}{\beta^4}.\left[\left(\frac{\partial^2 w}{\partial Q^2}\right)^2 - 2g_2 a\beta.\frac{\partial^2 w}{\partial Q^2}.\frac{\partial \phi_y}{\partial Q} + g_3 a^2\beta^2.\left(\frac{\partial \phi_y}{\partial Q}\right)^2\right]$$

$$+\frac{B_{23}}{\beta^3}.\left[4\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial^2 w}{\partial Q^2} - 2g_2 a.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial^2 w}{\partial Q^2} - 4g_2 a\beta.\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial Q}\right.$$

$$\left.+ 2g_3 a^2\beta.\left(\frac{\partial \phi_x}{\partial Q} + \beta.\frac{\partial \phi_y}{\partial R}\right).\frac{\partial \phi_y}{\partial Q}\right]$$

$$+\frac{B_{33}}{\beta^2}.\left[4\left(\frac{\partial^2 w}{\partial R\partial Q}\right)^2 - 2g_2 a.\left(\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_x}{\partial Q} + \beta\frac{\partial^2 w}{\partial R\partial Q}.\frac{\partial \phi_y}{\partial R}\right)\right.$$

$$\left.+ g_3 a^2.\left(\left(\frac{\partial \phi_x}{\partial Q}\right)^2 + 2\beta\frac{\partial \phi_x}{\partial Q}.\frac{\partial \phi_y}{\partial R} + \beta^2.\left(\frac{\partial \phi_y}{\partial R}\right)^2\right)\right] + a^2B_{44}.\left(\frac{a}{t}\right)^2.g_4.\emptyset_x{}^2$$

$$+ a^2B_{55}.\left(\frac{a}{t}\right)^2.g_4.\emptyset_y{}^2\Bigg\} - 2\frac{qa^4}{D_0}w\Bigg\}\,dR\,dQ \qquad 4.1$$

4.1.2 Governing equation and compatibility equations

The governing equation of equilibrium and two compatibility equations for thick anisotropic rectangular plate which are derived in this study as Equations (3.96), (3.97) and (3.98) are presented in Equations (4.2), (4.3) and (4.4).

$$\int_0^1\int_0^1 \Bigg\{ B_{11}.\frac{\partial^4 w}{\partial R^4} + \frac{2}{\beta^2}.B_{xy}\frac{\partial^4 w}{\partial R^2\,\partial Q^2} + \frac{B_{22}}{\beta^4}.\frac{\partial^4 w}{\partial Q^4} + 4\frac{B_{13}}{\beta}.\frac{\partial^4 w}{\partial R^3 \partial Q} + 4\frac{B_{23}}{\beta^3}.\frac{\partial^4 w}{\partial R \partial Q^3}$$

$$- \frac{g_2 a}{2}[2B_{11} + B_{12}]\frac{\partial^3 \phi_x}{\partial R^3} - \frac{g_2 a}{2\beta^2}.B_{xy}\frac{\partial^3 \phi_x}{\partial R\,\partial Q^2} - 3g_2 a.\frac{B_{13}}{\beta}\frac{\partial^3 \phi_x}{\partial R^2 \partial Q}$$

$$- \frac{g_2 a}{2\beta^3}[B_{12} + 2B_{22}]\frac{\partial^3 \phi_y}{\partial Q^3} - \frac{g_2 a}{2\beta}B_{xy}\frac{\partial^3 \phi_y}{\partial R^2 \partial Q} - 3g_2 a.\frac{B_{23}}{\beta^2}\frac{\partial^3 \phi_y}{\partial R \partial Q^2} - g_2 a.B_{13}.\frac{\partial^3 \phi_y}{\partial R^3}$$

$$- \frac{g_2 a}{\beta^3}.B_{23}.\frac{\partial^3 \phi_x}{\partial Q^3} - \frac{q a^4}{D_0}\Bigg\} dR\,dQ = 0 \qquad 4.2$$

$$B_{11}.\left[-g_2 a.\frac{\partial^3 w}{\partial R^3} + g_3 a^2.\frac{\partial^2 \phi_x}{\partial R^2}\right] + \frac{B_{12}}{2\beta^2}.\left[-g_2 a\beta^2\frac{\partial^3 w}{\partial R^3} - g_2 a.\frac{\partial^3 w}{\partial R\,\partial Q^2} + 2g_3 a^2 \beta.\frac{\partial^2 \phi_y}{\partial R \partial Q}\right]$$

$$+ \frac{B_{13}}{\beta}.\left[-g_2 a.\frac{\partial^3 w}{\partial Q\,\partial R^2} - 2g_2 a\frac{\partial^3 w}{\partial Q\,\partial R^2} + 2g_3 a^2.\frac{\partial^2 \phi_x}{\partial R \partial Q} + g_3 a^2.\beta.\frac{\partial^2 \phi_y}{\partial R^2}\right]$$

$$+ \frac{B_{23}}{\beta^3}.\left[-g_2 a.\frac{\partial^3 w}{\partial Q^3} + g_3 a^2 \beta.\frac{\partial^2 \phi_y}{\partial Q^2}\right]$$

$$+ \frac{B_{33}}{\beta^2}.\left[-g_2 a.\frac{\partial^3 w}{\partial R\,\partial Q^2} + g_3 a^2.\frac{\partial^2 \phi_x}{\partial Q^2} + g_3 a^2.\beta\frac{\partial^2 \phi_y}{\partial R \partial Q}\right] + a^2 B_{44}.\left(\frac{a}{t}\right)^2.g_4.\emptyset_x$$

$$= 0 \qquad 4.3$$

$$\frac{B_{12}}{2\beta^2}.\left[-g_2\frac{a}{\beta}\frac{\partial^3 w}{\partial Q^3}-g_2 a\beta.\frac{\partial^3 w}{\partial R^2\partial Q}+2g_3a^2\beta.\frac{\partial^2\phi_x}{\partial R\partial Q}\right]+\frac{B_{13}}{\beta}.\left[-g_2a.\beta.\frac{\partial^3 w}{\partial R^3}+g_3a^2.\beta.\frac{\partial^2\phi_x}{\partial R^2}\right]$$

$$+\frac{B_{22}}{\beta^4}.\left[-g_2a\beta.\frac{\partial^3 w}{\partial Q^3}+g_3a^2\beta^2.\frac{\partial^2\phi_y}{\partial Q^2}\right]$$

$$+\frac{B_{23}}{\beta^3}.\left[-g_2a.\beta.\frac{\partial^3 w}{\partial R\,\partial Q^2}-2g_2a\beta.\frac{\partial^3 w}{\partial R\partial Q^2}+g_3a^2\beta.\frac{\partial^2\phi_x}{\partial Q^2}+2g_3a^2\beta^2.\frac{\partial^2\phi_y}{\partial R\partial Q}\right]$$

$$+\frac{B_{33}}{\beta^2}.\left[-g_2a.\beta\frac{\partial^3 w}{\partial R^2\partial Q}+g_3a^2.\beta\frac{\partial^2\phi_x}{\partial R\partial Q}+g_3a^2.\beta^2.\frac{\partial^2\phi_y}{\partial R^2}\right]$$

$$+a^2B_{55}.\left(\frac{a}{t}\right)^2.g_4.\emptyset_y=0 \qquad 4.4$$

4.1.3 Exact polynomial displacement functions and polynomial stiffness coefficients

4.1.3.1 Exact polynomial displacement functions

The displacement functions; namely, central deflection (w), shear deformation rotation in x direction ($\emptyset_x$) and shear deformation rotation in y direction ($\emptyset_y$) as obtained for rectangular plate of various boundary conditions are presented in Table 4.1a. (Note: The meaningful points i.e. (x = a, y = b; x = $\frac{a}{2}$, y = $\frac{b}{2}$; x = 0, y = 0) were chosen for the solutions to match the related example problems as used by previous Authors).

Table 4.1a: Exact polynomial displacement functions for thick anisotropic rectangular plate.

Mathematical notation		Exact shape function	Non-dimensional values of displacements	Meaningful points
		SSSS Rectangular Plate		
W	A_1h	$A_1(R-2R^3+R^4)(Q-2Q^3+Q^4)$	$0.09765625A_1$	$\frac{a}{2}, \frac{b}{2}$
$\emptyset_x$	$A_2.\frac{dh}{dR}$	$A_2(1-6R^2+4R^3)(Q-2Q^3+Q^4)$	$0.3125A_2$	$0, \frac{b}{2}$
$\emptyset_y$	$A_3.\frac{dh}{dQ}$	$A_3(R-2R^3+R^4)\ (1-6Q^2+4Q^3)$	$0.3125A_3$	$\frac{a}{2}, 0$
${\emptyset_x}^I$	$A_2.\frac{d^2h}{dR^2}$	$A_2(R^2-R)(Q-2Q^3+Q^4).12$	$-0.9375A_2$	$\frac{a}{2}, \frac{b}{2}$
${\emptyset_y}^I$	$A_3.\frac{d^2h}{dQ^2}$	$A_3(R-2R^3+R^4)(Q^2-Q).12$	$-0.9375A_2$	$\frac{a}{2}, \frac{b}{2}$
${W_{xy}}^{II}$	$A_1.\frac{d^2w}{dRdQ}$	$A_1(1-6R^2+4R^3)(1-6Q^2+4Q^3)$	$1.A_1$	a, b, & 0, 0
		CCCC Rectangular Plate		
W	A_1h	$A_1(R^2-2R^3+R^4)(Q^2-2Q^3+Q^4)$	$0.00390625A_1$	$\frac{a}{2}, \frac{b}{2}$
$\emptyset_x$	$A_2.\frac{dh}{dR}$	$A_2(2R-6R^2+4R^3)(Q^2-2Q^3+Q^4)$	$0.A_2$	a, b, $\frac{a}{2}, \frac{b}{2}$, 0, 0
$\emptyset_y$	$A_3.\frac{dh}{dQ}$	$A_3(R^2-2R^3+R^4)(2Q-6Q^2+4Q^3)$	$0.A_3$	a, b, $\frac{a}{2}, \frac{b}{2}$, 0, 0
${\emptyset_x}^I$	$A_2.\frac{d^2h}{dR^2}$	$A_2(2-12R+12R^2)(Q^2-2Q^3+Q^4)$	$-0.0625A_2$	$\frac{a}{2}, \frac{b}{2}$
${\emptyset_y}^I$	$A_3.\frac{d^2h}{dQ^2}$	$A_3(R^2-2R^3+R^4)(2-12Q+12Q^2)$	$-0.0625A_3$	$\frac{a}{2}, \frac{b}{2}$
${W_{xy}}^{II}$	$A_1.\frac{d^2w}{dRdQ}$	$A_1(2R-6R^2+4R^3)(2Q-6Q^2+4Q^3)$	$0.A_1$	a, b, $\frac{a}{2}, \frac{b}{2}$, 0, 0

Table 4.1a: Continued

		CSSS Rectangular Plate		
W	$A_1 h$	$A_1(R-2R^3+R^4)(1.5Q^2-2.5Q^3+Q^4)$	$0.039062A_1$	$\frac{a}{2}, \frac{b}{2}$
$\emptyset_x$	$A_2.\frac{dh}{dR}$	$A_2(1-6R^2+4R^3)(1.5Q^2-2.5Q^3+Q^4)$	$0.125A_2$	$0, \frac{b}{2},$
$\emptyset_y$	$A_3.\frac{dh}{dQ}$	$A_3(R-2R^3+R^4)(3Q-7.5Q^2+4Q^3)$	$0.039062A_3$	$\frac{a}{2}, \frac{b}{2}$
$\emptyset_x{}^I$	$A_2.\frac{d^2h}{dR^2}$	$A_2 12(R^2 - R)(1.5Q^2 - 2.5Q^3 + Q^4)$	$-0.375A_2$	$\frac{a}{2}, \frac{b}{2}$
$\emptyset_y{}^I$	$A_3.\frac{d^2h}{dQ^2}$	$A_3(R-2R^3+R^4)(1-5Q+4Q^2)$	$-0.46875A_3$	$\frac{a}{2}, \frac{b}{2}$
$W_{xy}{}^{II}$	$A_1.\frac{d^2w}{dRdQ}$	$A_1(1-6R^2+4R^3)(3Q-7.5Q^2+4Q^3)$	$0.125A_1$	$0, \frac{b}{2}$
		CCSS Rectangular Plate		
W	$A_1 h$	$A_1(1.5R^2-2.5R^3+R^4)(1.5Q^2-2.5Q^3+Q^4)$	$0.015625A_1$	$\frac{a}{2}, \frac{b}{2}$
$\emptyset_x$	$A_2.\frac{dh}{dR}$	$A_2(3R-7.5R^2+4R^3)(1.5Q^2-2.5Q^3+Q^4)$	$0.125A_2$	$0, \frac{b}{2}$
$\emptyset_y$	$A_3.\frac{dh}{dQ}$	$A_3(1.5R^2-2.5R^3+R^4)(3Q-7.5Q^2+4Q^3)$	$0.0390625A_3$	$\frac{a}{2}, \frac{b}{2}$
$\emptyset_x{}^I$	$A_2.\frac{d^2h}{dR^2}$	$A_2(3 - 15R + 12R^2)(1.5Q^2 - 2.5Q^3 + Q^4)$	$-0.375A_2$	$\frac{a}{2}, \frac{b}{2}$
$\emptyset_y{}^I$	$A_3.\frac{d^2h}{dQ^2}$	$A_3(1.5R^2-2.5R^3+R^4)(3 - 15Q + 12Q^2)$	$-0.46875A_3$	$\frac{a}{2}, \frac{b}{2}$
$W_{xy}{}^{II}$	$A_1.\frac{d^2w}{dRdQ}$	$A_1(3R-7.5R^2+4R^3)(3Q-7.5Q^2+4Q^3)$	$0.125A_1$& $0.5A_1$	$0, \frac{b}{2}$, & a, b,
		CSCS Rectangular Plate		
W	$A_1 h$	$A_1(R-2R^3+R^4)(Q^2-2Q^3+Q^4)$	$0.01953125A_1$	$\frac{a}{2}, \frac{b}{2}$
$\emptyset_x$	$A_2.\frac{dh}{dR}$	$A_2(1-6R^2+4R^3)(Q^2-2Q^3+Q^4)$	$0.0625A_2$	$0, \frac{b}{2}$
$\emptyset_y$	$A_3.\frac{dh}{dQ}$	$A_3(R-2R^3+R^4)(Q-6Q^2+4Q^3)$	$0.3125A_3$	a, b, $\frac{a}{2}, \frac{b}{2}$, 0, 0

Table 4.1a: Continued

$\emptyset_x{}^{I}$	$A_2.\frac{d^2h}{dR^2}$	$A_2 12(R^2-R)(Q^2-2Q^3+Q^4)$	$-0.1875A_2$	$\frac{a}{2},\frac{b}{2}$
$\emptyset_y{}^{I}$	$A_3.\frac{d^2h}{dQ^2}$	$A_3(R\text{-}2R^3\text{+}R^4)(2\text{-}12Q\text{+}12Q^2)$	$-0.3125A_2$	$\frac{a}{2},\frac{b}{2}$
$W_{xy}{}^{II}$	$A_1.\frac{d^2w}{dRdQ}$	$A_1(1\text{-}6R^2\text{+}4R^3)\ (2Q\text{-}6Q^2\text{+}4Q^3)$	$0.A_1$	a, b, $\frac{a}{2},\frac{b}{2}$, 0, 0
		CCCS Rectangular Plate		
W	A_1h	$A_1(1.5R^2\text{-}2.5R^3\text{+}R^4)(Q^2\text{-}2Q^3\text{+}Q^4)$	$0.007813A_1$	$\frac{a}{2},\frac{b}{2}$
$\emptyset_x$	$A_2.\frac{dh}{dR}$	$A_2(3R\text{-}7.5R^2\text{+}4R^3)(Q^2\text{-}2Q^3\text{+}Q^4)$	$0.007813A_2$	$\frac{a}{2},\frac{b}{2}$
$\emptyset_y$	$A_3.\frac{dh}{dQ}$	$A_3(1.5R^2\text{-}2.5R^3\text{+}R^4)(2Q\text{-}6Q^2\text{+}4Q^3)$	$0.A_3$	a, b, $\frac{a}{2},\frac{b}{2}$, 0, 0
$\emptyset_x{}^{I}$	$A_2.\frac{d^2h}{dR^2}$	$A_2(3-15R+12R^2)(Q^2-2Q^3+Q^4)$	$-0.09375A_3$	$\frac{a}{2},\frac{b}{2}$
$\emptyset_y{}^{I}$	$A_3.\frac{d^2h}{dQ^2}$	$A_3(1.5R^2\text{-}2.5R^3\text{+}R^4)(2-12Q+12Q^3)$	$-0.125A_3$	$\frac{a}{2},\frac{b}{2}$
$W_{xy}{}^{II}$	$A_1.\frac{d^2w}{dRdQ}$	$A_1(3R\text{-}7.5R^2\text{+}4R^3)(2Q\text{-}6Q^2\text{+}4Q^3)$	$0.A_1$	a, b, $\frac{a}{2},\frac{b}{2}$, 0, 0
		SSFS Rectangular Plate		
W	A_1h	$A_1(R\text{-}2R^3\text{+}R^4)((\frac{7}{3}Q-\frac{10}{3}Q^3+\frac{10}{3}Q^4\text{-}\ Q^5)$	$0.289713542A_1$	$\frac{a}{2},\frac{b}{2}$
$\emptyset_x$	$A_2.\frac{dh}{dR}$	$A_2(1\text{-}6R^2\text{+}4R^3)(\frac{7}{3}Q-\frac{10}{3}Q^3+\frac{10}{3}Q^4\text{-}\ Q^5)$	$0.927083333A_2$	0, $\frac{b}{2}$,
$\emptyset_y$	$A_3.\frac{dh}{dQ}$	$A_3(R\text{-}2R^3\text{+}R^4)(\frac{7}{3}-10Q^2+\frac{40}{3}Q^3\text{-}\ 5Q^4)$	$0.37109375A_3$	$\frac{a}{2},\frac{b}{2}$
$\emptyset_x{}^{I}$	$A_2.\frac{d^2h}{dR^2}$	$A_2 12(R^2-R)(\frac{7}{3}Q-\frac{10}{3}Q^3+\frac{10}{3}Q^4\text{-}\ Q^5)$	$-2.78125A_2$	$\frac{a}{2},\frac{b}{2}$
$\emptyset_y{}^{I}$	$A_3.\frac{d^2h}{dQ^2}$	$A_3(R\text{-}2R^3\text{+}R^4)(\text{-}20Q\text{+}40Q^2\text{-}20Q^3)$	$-0.78125A_2$	$\frac{a}{2},\frac{b}{2}$
$W_{xy}{}^{II}$	$A_1.\frac{d^2w}{dRdQ}$	$A_1(1\text{-}6R^2\text{+}4R^3)(\frac{7}{3}-10Q^2+\frac{40}{3}Q^3\text{-}5Q^4)$	$1.1875A_1$ & -0.66667	0, $\frac{b}{2}$ & a, b

Table 4.1a: Continued

		CCFC Rectangular Plate		
W	A_1h	$A_1(R^2-2R^3+R^4)((2.8Q^2-5.2Q^3+3.8Q^4-Q^5)$	$0.016015625A_1$	$\frac{a}{2}, \frac{b}{2}$
$\emptyset_x$	$A_2.\frac{dh}{dR}$	$A_2(2R-6R^2+4R^3)(2.8Q^2-5.2Q^3+3.8Q^4-Q^5)$	$0.A_2$	$\frac{a}{2}, \frac{b}{2}$
$\emptyset_y$	$A_3.\frac{dh}{dQ}$	$A_3(R^2-2R^3+R^4)(5.6Q-15.9Q^2+15.2Q^3-5Q^4)$	$0.02578125A_3$	$\frac{a}{2}, \frac{b}{2}$
${\emptyset_x}^I$	$A_2.\frac{d^2h}{dR^2}$	$A_2(2-12R+12R^2)(2.8Q^2-5.2Q^3+3.8Q^4-Q^5)$	$-0.25625A_2$	$\frac{a}{2}, \frac{b}{2}$
${\emptyset_y}^I$	$A_3.\frac{d^2h}{dQ^2}$	$A_3(R^2-2R^3+R^4)(5.6-31.8Q+45.6Q^2-20Q^3)$	$-0.0875A_3$	$\frac{a}{2}, \frac{b}{2}$
${W_{xy}}^{II}$	$A_1.\frac{d^2w}{dRdQ}$	$A_1(2R-6R^2+4R^3)(5.6Q-15.9Q^2+15.2Q^3-5Q^4)$	$0.A_1$	a, b, $\frac{a}{2}, \frac{b}{2}$, 0, 0
		SCFS Rectangular Plate		
W	A_1h	$A_1(1.5R^2-2.5R^3+R^4)(\frac{7}{3}Q-\frac{10}{3}Q^3+\frac{10}{3}Q^4-Q^5)$	$0.115885417A_1$	$\frac{a}{2}, \frac{b}{2}$
$\emptyset_x$	$A_2.\frac{dh}{dR}$	$A_2(3R-7.5R^2+4R^3)(\frac{7}{3}Q-\frac{10}{3}Q^3+\frac{10}{3}Q^4-Q^5)$	$0.115885417A_2$	$\frac{a}{2}, \frac{b}{2}$
$\emptyset_y$	$A_3.\frac{dh}{dQ}$	$A_3(1.5R^2-2.5R^3+R^4)(\frac{7}{3}-10Q^2+\frac{40}{3}Q^3-5Q^4)$	$0.1484375A_3$	$\frac{a}{2}, \frac{b}{2}$
${\emptyset_x}^I$	$A_2.\frac{d^2h}{dR^2}$	$A_2(3-15R+12R^2)(\frac{7}{3}Q-\frac{10}{3}Q^3+\frac{10}{3}Q^4-Q^5)$	$-1.390625A_2$	$\frac{a}{2}, \frac{b}{2}$
${\emptyset_y}^I$	$A_3.\frac{d^2h}{dQ^2}$	$A_3(1.5R^2-2.5R^3+R^4)(-20Q+40Q^2-20Q^3)$	$-0.3125A_3$	$\frac{a}{2}, \frac{b}{2}$
${W_{xy}}^{II}$	$A_1.\frac{d^2w}{dRdQ}$	$A_1(3R-7.5R^2+4R^3)(\frac{7}{3}-10Q^2+\frac{40}{3}Q^3-5Q^4)$	$10.1484375A_1$ &-0.333333333	$\frac{a}{2}, \frac{b}{2}$ & a, b
		CSFS Rectangular Plate		
W	A_1h	$A_1(R-2R^3+R^4)(2.8Q^2-5.2Q^3+3.8Q^4-Q^5)$	$0.080078125A_1$	$\frac{a}{2}, \frac{b}{2}$
$\emptyset_x$	$A_2.\frac{dh}{dR}$	$A_2(1-6R^2+4R^3)(2.8Q^2-5.2Q^3+3.8Q^4-Q^5)$	$0.25625A_2$	$0, \frac{b}{2}$
$\emptyset_y$	$A_3.\frac{dh}{dQ}$	$A_3(R-2R^3+R^4)(5.6Q-15.9Q^2+15.2Q^3-5Q^4)$	$0.15234375A_3$	$\frac{a}{2}, \frac{b}{2}$

Table 4.1a: Continued

$\emptyset_x{}^I$	$A_2.\frac{d^2h}{dR^2}$	$A_2 12(R^2-R)$ $(2.8Q^2$-$5.2Q^3$+$3.8Q^4$-$Q^5)$	-0.76875A_2	$\frac{a}{2},\frac{b}{2}$
$\emptyset_y{}^I$	$A_3.\frac{d^2h}{dQ^2}$	$A_3(R$-$2R^3$+$R^4)(5.6$-$31.8Q$+$45.6Q^2$-$20Q^3)$	-0.34375A_3	$\frac{a}{2},\frac{b}{2}$
$W_{xy}{}^{II}$	$A_1.\frac{d^2w}{dRdQ}$	$A_3(1$-$6R^2$+$4R^3)(5.6Q$-$15.9Q^2$+$15.2Q^3$-$5Q^4)$	0.4875A_3 & -0.2A_3	0, $\frac{b}{2}$ & a, b
		CCFS Rectangular Plate		
W	A_1h	$A_1(1.5R^2$-$2.5R^3$+$R^4)$ $(2.8Q^2$-$5.2Q^3$+$3.8Q^4$-$Q^5)$	0.03203125A_1	$\frac{a}{2},\frac{b}{2}$
$\emptyset_x$	$A_2.\frac{dh}{dR}$	$A_2(3R$-$7.5R^2$+$4R^3)$ $(2.8Q^2$-$5.2Q^3$+$3.8Q^4$-$Q^5)$	0.03203125A_2	$\frac{a}{2},\frac{b}{2}$
$\emptyset_y$	$A_3.\frac{dh}{dQ}$	$A_3(1.5R^2$-$2.5R^3$+$R^4)$ $(5.6Q$-$15.9Q^2$+$15.2Q^3$-$5Q^4)$	0.0609375A_3	$\frac{a}{2},\frac{b}{2}$
$\emptyset_x{}^I$	$A_2.\frac{d^2h}{dR^2}$	$A_2(3-15R+12R^2)(2.8Q^2$-$5.2Q^3$+$3.8Q^4$-$Q^5)$	-0.384375A_2	$\frac{a}{2},\frac{b}{2}$
$\emptyset_y{}^I$	$A_3.\frac{d^2h}{dQ^2}$	$A_3(1.5R^2$-$2.5R^3$+$R^4)(5.6$-$31.8Q$+$45.6Q^2$-$20Q^3)$	-0.1375A_3	$\frac{a}{2},\frac{b}{2}$
$W_{xy}{}^{II}$	$A_1.\frac{d^2w}{dRdQ}$	$A_1(3R$-$7.5R^2$+$4R^3)(5.6Q$-$15.9Q^2$+$15.2Q^3$-$5Q^4)$	0.0609375.A_1 & -0.1A_1	$\frac{a}{2},\frac{b}{2}$, a, b
		SCFC Rectangular Plate		
W	A_1h	$A_1(R^2$-$2R^3$+$R^4)(\frac{7}{3}Q-\frac{10}{3}Q^3+\frac{10}{3}Q^4$- $Q^5)$	0.057942708A_1	$\frac{a}{2},\frac{b}{2}$
$\emptyset_x$	$A_2.\frac{dh}{dR}$	$A_2(2R$-$6R^2$+$4R^3)(\frac{7}{3}Q-\frac{10}{3}Q^3+\frac{10}{3}Q^4$- $Q^5)$	0.A_2	a, b, $\frac{a}{2},\frac{b}{2}$, 0, 0
$\emptyset_y$	$A_3.\frac{dh}{dQ}$	$A_3(R^2$-$2R^3$+$R^4)(\frac{7}{3}-10Q^2+\frac{40}{3}Q^3$- $5Q^4)$	0.07421875A_3	$\frac{a}{2},\frac{b}{2}$

Table 4.1a: Continued

$\emptyset_x{}^{I}$	$A_2.\frac{d^2h}{dR^2}$	$A_2(2\text{-}12R+12R^2)(\frac{7}{3}Q - \frac{10}{3}Q^3 + \frac{10}{3}Q^4\text{-}Q^5)$	-0.927083333A_2 & 2.666666667	$\frac{a}{2}, \frac{b}{2}$, & a, b
$\emptyset_y{}^{I}$	$A_3.\frac{d^2h}{dQ^2}$	$A_3(R^2\text{-}2R^3+R^4)$ $(\text{-}20Q+40Q^2\text{-}20Q^3)$	-0.15625A_3	a, b, $\frac{a}{2}, \frac{b}{2}$, 0, 0
$W_{xy}{}^{II}$	$A_1.\frac{d^2w}{dRdQ}$	$A_1(2R\text{-}6R^2+4R^3)(\frac{7}{3} - 10Q^2 + \frac{40}{3}Q^3\text{-}5Q^4)$	0.A_1	a, b, $\frac{a}{2}, \frac{b}{2}$, 0, 0

4.1.3.2 Polynomial stiffness values (k) of the rectangular plates

The polynomial stiffness values (k) of rectangular plates for the twelve boundary conditions were obtained and the results are presented in Table 4.1b.

Table 4.1b Stiffness value (k) for rectangular plate

Plate type	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8
SSSS	0.23619	0.23592	0.23619	0	0	0.02390	0.02390	0.04000
CCCC	0.00126	0.00036	0.00127	0	0	0.00003	0.00003	0.00111
CSSS	0.03619	0.04163	0.08857	0	0	0.00366	0.00422	0.01500
CCSS	0.01357	0.00735	0.01357	0	0	0.00065	0.00065	0.00563
CSCS	0.03937	0.00925	0.03937	0	0	0.000937	0.000771	0.00667
CCCS	0.00286	0.00163	0.00603	0	0	0.00014	0.00014	0.00250
SSFS	4.02578	1.033107	0.18746	0	0	0.407371	0.104661	0.16667
CCFC	1.848889	0.195918	0.045714	0	0	0.0440211	0.0163265	0.04000
SCFS	1.50967	0.1823129	0.02872	0.11111	0	0.071889	0.016033	0.0625
CSFS	11.0933	4.99592	1.417142	0	0	1.1225397	0.506122	0.240000
CCFS	0.67096	0.040514	0.006047	0	0	0.0159753	0.0033762	0.0277778
SCFC	4.16000	0.8816327	0.217985	0.5625	0	0.198095	0.077531	0.09000

4.1.4 The formulas for determining the displacements and stresses

The formulas for determining the displacements as well as the stresses of a thick anisotropic rectangular plate are derived in equations (3.199c), (3.205), (3.207), (3.209), (3.211), (3.213), (3.218) and (3.220) as presented in equation (4.5), (4.6), (4.7), (4.8), (4.9), (4.10), (4.11) and (4.12).

$$w\frac{E_0 t^3}{qa^4} = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{k_8}{k_T}\right)h = \bar{w} \qquad 4.5$$

$$u\frac{E_0}{qa}.\left(\frac{t}{a}\right)^2 = 12[1-\mu_{xy}\mu_{yx}]\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = \bar{u} \qquad 4.6$$

$$v\frac{E_0}{qa}.\left(\frac{t}{a}\right)^2 = 12[1-\mu_{xy}\mu_{yx}]\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = \bar{v} \qquad 4.7$$

$$\frac{\sigma_R}{q}.\left(\frac{t}{a}\right)^2 = 12S\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = \bar{\sigma}_R \qquad 4.8$$

$$\frac{\sigma_Q}{q}\left(\frac{t}{a}\right)^2 = 12S\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = \bar{\sigma}_Q \qquad 4.9$$

$$\frac{\tau_{RQ}}{q}\left(\frac{t}{a}\right)^2 = 12S.\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = \bar{\tau}_{RQ} \qquad 4.10$$

$$\frac{\tau_{RS}}{q}\left(\frac{t}{a}\right) = 12\left(\frac{a}{t}\right)^2 B_{44}(P_2 - 4P_2 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = \bar{\tau}_{RS} \qquad 4.11$$

$$\frac{\tau_{QS}}{q}\left(\frac{t}{a}\right) = 12\left(\frac{a}{t}\right)^2 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = \bar{\tau}_{QS} \qquad 4.12$$

4.1.5 Results of numerical problems

The numerical values for a typical thick anisotropic rectangular plate in-plane displacements ($\bar{u}$ and $\bar{v}$), out-plane displacement ($\bar{w}$), in-plane stresses ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$) and out-plane stresses ($\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$) as determined from equations (3.199c), (3.205), (3.207), (3.209), (3.211), (3.213), (3.218) and (3.220) are presented on Tables (4.2) to (4.13).

Table 4.2a: Numerical values of displacements and stresses for SSSS thick anisotropic rectangular plate for 0^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.0180	-0.32005	-0.60615	0.980772	0.0364545	0.0592765	0.59966	0.06820
10	0.01005	-1.15660	-1.51589	0.881023	0.0259871	0.0427599	0.67721	0.05531
20	0.00775	-4.4924	-4.87597	0.853597	0.0222705	0.0374734	0.70067	0.05011
30	0.00731	-10.0509	-10.4394	0.848404	0.0215162	0.0364274	0.70524	0.04903
40	0.00715	-17.8329	-18.2231	0.846577	0.0212470	0.0360560	0.70686	0.04864
50	0.00708	-27.8382	-28.2292	0.845730	0.0211214	0.0358832	0.70761	0.04846
60	0.00704	-40.0669	-40.4583	0.845270	0.0210529	0.0357890	0.70802	0.04836
70	0.00701	-54.5190	-54.9107	0.844992	0.0210115	0.0357321	0.70827	0.04830
80	0.0070	-71.1945	-71.5863	0.844811	0.0209846	0.0356952	0.70843	0.04826
90	0.00699	-90.0934	-90.4853	0.844688	0.0209662	0.0356699	0.70854	0.04823
100	0.00698	-111.216	-111.608	0.844599	0.0209530	0.0356517	0.70862	0.04821

Table 4.2b: Numerical values of displacements and stresses for SSSS thick anisotropic rectangular plate for 15^0 @ α = 5 to 100, β = 1

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.01245	-0.2212	-0.379625	0.661806	0.0977385	0.1517064	0.41532	0.071053
10	0.00791	-0.9118	-1.103948	0.658215	0.0849413	0.1272449	0.53056	0.096888
20	0.00634	-3.6773	-3.879932	0.656304	0.0807469	0.1192681	0.57014	0.106484
30	0.00602	-8.2868	-8.491418	0.655874	0.0799134	0.1176856	0.57813	0.108468
40	0.00591	-14.740	-14.94539	0.655717	0.0796172	0.1171235	0.58098	0.109179
50	0.00586	-23.037	-23.24277	0.655643	0.0794793	0.1168619	0.58231	0.109512
60	0.00583	-33.178	-33.38378	0.655603	0.0794042	0.1167193	0.58304	0.109693
70	0.00581	-45.163	-45.36852	0.655578	0.0793588	0.1166332	0.58347	0.109803
80	0.00580	-58.991	-59.19701	0.655562	0.0793293	0.1165773	0.58376	0.109874
90	0.00579	-74.663	-74.86926	0.655551	0.0793091	0.1165390	0.58395	0.109923
100	0.00579	-92.179	-92.38529	0.655543	0.0792946	0.1165115	0.58409	0.109958

Table 4.2c: Numerical values of displacements and stresses for SSSS thick anisotropic rectangular plate for 30^0 @ α = 5 to 100, β = 1

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00774	-0.15608	-0.179078	0.374328	0.1433016	0.2109912	0.23050	0.07840
10	0.00568	-0.68334	-0.656346	0.391837	0.1468940	0.2108444	0.33873	0.15169
20	0.00471	-2.75267	-2.695600	0.396415	0.1489391	0.2143670	0.38959	0.19008
30	0.00448	-6.19068	-6.126367	0.397230	0.1494259	0.2153889	0.40116	0.19905
40	0.00440	-11.0020	-10.93497	0.397511	0.1496063	0.2157821	0.40540	0.20236
50	0.00436	-17.1873	-17.11908	0.397641	0.1496919	0.2159707	0.40740	0.20393
60	0.00434	-24.7471	-24.67808	0.397711	0.1497388	0.2160750	0.40850	0.20479
70	0.00433	-33.6811	-33.61173	0.397752	0.1497673	0.2161385	0.40916	0.20531
80	0.00432	-43.9896	-43.91996	0.397780	0.1497858	0.2161799	0.40960	0.20565
90	0.00432	-55.6726	-55.60270	0.397799	0.1497986	0.2162085	0.40989	0.20588
100	0.00431	-68.7299	-68.65994	0.397812	0.1498077	0.2162290	0.41011	0.20605

Table 4.2d: Numerical values of displacements and stresses for SSSS thick anisotropic rectangular plate for 45^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00680	-0.19077	-0.089217	0.229241	0.2170548	0.22904	0.12201	0.10974
10	0.00521	-0.68901	-0.484018	0.236799	0.2306494	0.23989	0.21532	0.20913
20	0.00425	-2.54258	-2.275540	0.241002	0.2389991	0.24634	0.27041	0.26839
30	0.00402	-5.59693	-5.314405	0.242033	0.2410916	0.24794	0.28410	0.28315
40	0.00393	-9.86670	-9.578364	0.242420	0.2418793	0.24855	0.28925	0.28870
50	0.00389	-15.3545	-15.06343	0.242604	0.2422543	0.24883	0.29169	0.29135
60	0.00386	-22.0612	-21.76853	0.242705	0.2424610	0.24899	0.29305	0.29280
70	0.00385	-29.9868	-29.69326	0.242766	0.2425866	0.24909	0.29387	0.29368
80	0.00384	-39.1316	-38.83746	0.242806	0.2426685	0.24915	0.29440	0.29426
90	0.00383	-49.4956	-49.20106	0.242834	0.2427248	0.24919	0.29477	0.29466
100	0.00383	-61.0789	-60.78399	0.242854	0.2427652	0.24922	0.29503	0.29494

Table 4.2e: Numerical values of displacements and stresses for SSSS thick anisotropic rectangular plate for 60^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00896	-0.30878	-0.086577	0.144820	0.3249868	0.2488920	0.07430	0.16304
10	0.00643	-0.93244	-0.533919	0.147495	0.364930	0.2307812	0.14551	0.29731
20	0.00497	-3.05655	-2.556298	0.149099	0.3875076	0.2208424	0.18736	0.37509
30	0.00461	-6.50804	-5.982777	0.149497	0.3930315	0.2184275	0.19769	0.39423
40	0.00448	-11.3243	-10.78976	0.149646	0.3950991	0.2175250	0.20156	0.40140
50	0.00441	-17.5121	-16.97309	0.149717	0.3960814	0.2170964	0.20341	0.40481
60	0.00438	-25.0731	-24.53166	0.149757	0.3966220	0.2168606	0.20442	0.40668
70	0.00436	-34.0080	-33.46506	0.149780	0.3969503	0.2167174	0.20504	0.40782
80	0.00434	-44.3171	-43.77311	0.149796	0.3971644	0.2166241	0.20544	0.40857
90	0.00433	-56.0004	-55.45574	0.149806	0.3973116	0.2165599	0.20571	0.40908
100	0.00432	-69.0580	-68.51289	0.149814	0.3974171	0.2165139	0.20591	0.40945

Table 4.2f: Numerical values of displacements and stresses for SSSS thick anisotropic rectangular plate for 75^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.01683	-0.61624	-0.188913	0.123480	0.6256783	0.2033115	0.08573	0.29069
10	0.01018	-1.56106	-0.851163	0.097464	0.6419197	0.1522786	0.10206	0.46676
20	0.00706	-4.44752	-3.602851	0.084644	0.6513665	0.1270507	0.10788	0.54996
30	0.00636	-9.08430	-8.209154	0.081723	0.6535931	0.1212998	0.10910	0.56872
40	0.00610	-15.5475	-14.66125	0.080651	0.6544162	0.1191885	0.10953	0.57560
50	0.00598	-23.8493	-22.95775	0.080146	0.6548053	0.1181932	0.10974	0.57884
60	0.00591	-33.9927	-33.09829	0.079869	0.6550188	0.1176475	0.10985	0.58061
70	0.00587	-45.9789	-45.08273	0.079701	0.6551483	0.1173168	0.10992	0.58169
80	0.00585	-59.8083	-58.91103	0.079592	0.6552327	0.1171015	0.10996	0.58239
90	0.00583	-75.4812	-74.58315	0.079517	0.6552906	0.1169536	0.10999	0.58287
100	0.00582	-92.9977	-92.09909	0.079463	0.6553322	0.1168476	0.11001	0.58321

Table 4.2g: Numerical values of displacements and stresses for SSSS thick anisotropic rectangular plate for 90^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.02864	-1.06997	-0.350592	0.139262	1.08659	0.0909160	0.11324	0.47692
10	0.01410	-2.20768	-1.204006	0.075449	0.92186	0.0545870	0.07184	0.63094
20	0.00889	-5.65573	-4.546235	0.051070	0.86518	0.0408079	0.05475	0.68760
30	0.00783	-11.2375	-10.10619	0.045995	0.85368	0.0379445	0.05113	0.69929
40	0.00745	-19.0278	-17.88861	0.044173	0.84957	0.0369165	0.04983	0.70348
50	0.00727	-29.0370	-27.89414	0.043321	0.84765	0.0364360	0.04922	0.70544
60	0.00717	-41.2678	-40.12295	0.042856	0.84660	0.0361737	0.04889	0.70651
70	0.00711	-55.7212	-54.57511	0.042575	0.84597	0.0360151	0.04869	0.70715
80	0.00707	-72.3975	-71.25064	0.042392	0.84556	0.0359121	0.04856	0.70757
90	0.00705	-91.2970	-90.14955	0.042267	0.84528	0.0358413	0.04847	0.70786
100	0.00703	-112.419	-111.2718	0.042177	0.84508	0.0357906	0.04840	0.70807

Table 4.3a: Numerical values of displacements and stresses for CCCC thick anisotropic rectangular plate for 0^0 @ α = 5 to 100, β = 1.5

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.01349	-0.13438	-0.26688	-0.02330	-0.00145	0.03285	0.57552	0.04710
10	0.00485	-0.32510	-0.45571	-0.01404	-0.00066	0.01549	0.63041	0.02472
20	0.00244	-1.06578	-0.97263	-0.01147	-0.00039	0.00969	0.64738	0.01537
30	0.00198	-2.29763	-1.79867	-0.01098	-0.00034	0.00853	0.65073	0.01338
40	0.00181	-4.02187	-2.94989	-0.01080	-0.00032	0.00811	0.65192	0.01266
50	0.00174	-6.23865	-4.42854	-0.01072	-0.00031	0.00791	0.65247	0.01233
60	0.00170	-8.94801	-6.23522	-0.01068	-0.00030	0.00781	0.65277	0.01214
70	0.00167	-12.14996	-8.37012	-0.01065	-0.00030	0.00774	0.65295	0.01203
80	0.00166	-15.84451	-10.83333	-0.01064	-0.00030	0.00770	0.65307	0.01196
90	0.00165	-20.03166	-13.62488	-0.01063	-0.00030	0.00767	0.65315	0.01191
100	0.00164	-24.71141	-16.74480	-0.01062	-0.00030	0.00765	0.65321	0.01187

Table 4.3b: Numerical values of displacements and stresses for CCCC thick anisotropic rectangular plate for 15^0 @ α = 5 to 100, β = 1.5

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.01704	-0.16094	-0.31905	-0.31784	-0.02747	0.16179	0.74015	0.07032
10	0.00518	-0.34977	-0.45589	-0.13168	-0.01129	0.06619	0.66805	0.04452
20	0.00258	-1.14655	-0.99602	-0.08639	-0.00734	0.04286	0.65355	0.03529
30	0.00211	-2.47837	-1.88603	-0.07787	-0.00660	0.03846	0.65105	0.03334
40	0.00194	-4.34341	-3.13019	-0.07487	-0.00634	0.03691	0.65019	0.03263
50	0.00187	-6.74147	-4.72927	-0.07348	-0.00621	0.03619	0.64979	0.03230
60	0.00183	-9.67248	-6.68348	-0.07273	-0.00615	0.03580	0.64958	0.03212
70	0.00180	-13.13643	-8.99290	-0.07227	-0.00611	0.03557	0.64945	0.03202
80	0.00179	-17.13330	-11.65757	-0.07198	-0.00608	0.03542	0.64936	0.03194
90	0.00178	-21.66310	-14.67749	-0.07177	-0.00607	0.03531	0.64931	0.03190
100	0.00177	-26.72582	-18.05267	-0.07163	-0.00605	0.03524	0.64926	0.03186

Table 4.3c: Numerical values of displacements and stresses for CCCC thick anisotropic rectangular plate for 30^0 @ α = 5 to 100, β = 1.5

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.03572	-0.29479	-0.58125	-0.78345	-0.27034	0.72773	1.61547	0.19996
10	0.00607	-0.43594	-0.44583	-0.18882	-0.06493	0.17403	0.74450	0.10541
20	0.00304	-1.42985	-1.07693	-0.13135	-0.04509	0.12057	0.65425	0.10025
30	0.00255	-3.10156	-2.18541	-0.12255	-0.04206	0.11240	0.63967	0.09996
40	0.00239	-5.44349	-3.74457	-0.11960	-0.04104	0.10966	0.63470	0.09991
50	0.00231	-8.45495	-5.75121	-0.11826	-0.04057	0.10841	0.63242	0.09990
60	0.00227	-12.13578	-8.20455	-0.11753	-0.04032	0.10774	0.63119	0.09990
70	0.00225	-16.48591	-11.10430	-0.11710	-0.04017	0.10733	0.63045	0.09990
80	0.00223	-21.50532	-14.45037	-0.11682	-0.04008	0.10707	0.62997	0.09990
90	0.00222	-27.19402	-18.24268	-0.11662	-0.04001	0.10689	0.62964	0.09990
100	0.00221	-33.55198	-22.48122	-0.11649	-0.03996	0.10677	0.62940	0.09990

Table 4.3d: Numerical values of displacements and stresses for CCCC thick anisotropic rectangular plate for 45^0 @ α = 5 to 100, β = 1.5

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.06904	-0.56067	-0.86875	-0.97001	-0.97014	1.51050	3.13588	0.53925
10	0.00735	-0.63172	-0.41223	-0.16457	-0.16396	0.25473	0.74520	0.20407
20	0.00401	-2.05735	-1.27094	-0.13056	-0.13004	0.20201	0.60689	0.22221
30	0.00348	-4.42109	-2.82253	-0.12664	-0.12616	0.19599	0.58370	0.23057
40	0.00330	-7.72481	-5.01558	-0.12547	-0.12501	0.19421	0.57562	0.23407
50	0.00322	-11.97056	-7.84153	-0.12497	-0.12451	0.19344	0.57188	0.23581
60	0.00317	-17.15903	-11.29798	-0.12471	-0.12425	0.19304	0.56984	0.23678
70	0.00314	-23.29047	-15.38406	-0.12455	-0.12410	0.19281	0.56862	0.23738
80	0.00313	-30.36501	-20.09941	-0.12446	-0.12400	0.19266	0.56782	0.23778
90	0.00312	-38.38270	-25.44384	-0.12439	-0.12394	0.19256	0.56727	0.23805
100	0.00311	-47.34357	-31.41726	-0.12434	-0.12389	0.19248	0.56688	0.23824

Table 4.3e: Numerical values of displacements and stresses for CCCC thick anisotropic rectangular plate for 60^0 @ α = 5 to 100, β = 1.5

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.03562	-0.48056	-0.29559	-0.21602	-0.62236	0.57755	1.33066	0.36971
10	0.00948	-1.05484	-0.41963	-0.09860	-0.28306	0.26296	0.60188	0.33066
20	0.00580	-3.24420	-1.69261	-0.08456	-0.24328	0.22586	0.47506	0.40880
30	0.00508	-6.72005	-3.95267	-0.08216	-0.23662	0.21961	0.44698	0.43561
40	0.00482	-11.54461	-7.14610	-0.08133	-0.23433	0.21745	0.43644	0.44657
50	0.00469	-17.73414	-11.26123	-0.08094	-0.23327	0.21646	0.43141	0.45196
60	0.00463	-25.29361	-16.29461	-0.08074	-0.23269	0.21592	0.42863	0.45498
70	0.00459	-34.22487	-22.24495	-0.08061	-0.23235	0.21559	0.42694	0.45683
80	0.00456	-44.52877	-29.11170	-0.08053	-0.23213	0.21538	0.42584	0.45805
90	0.00454	-56.20568	-36.89457	-0.08047	-0.23197	0.21524	0.42508	0.45889
100	0.00453	-69.25583	-45.59342	-0.08043	-0.23186	0.21513	0.42454	0.45949

Table 4.3f: Numerical values of displacements and stresses for CCCC thick anisotropic rectangular plate for 75^0 @ α = 5 to 100, β = 1.5

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.02750	-0.66753	-0.17555	-0.04140	-0.44927	0.23217	0.58255	0.31703
10	0.01321	-1.77113	-0.55258	-0.02885	-0.31500	0.16244	0.38586	0.47980
20	0.00818	-4.83799	-2.31725	-0.02293	-0.25465	0.13057	0.28023	0.61958
30	0.00698	-9.48529	-5.33510	-0.02139	-0.23912	0.12233	0.25185	0.66022
40	0.00653	-15.89379	-9.57594	-0.02079	-0.23316	0.11917	0.24086	0.67618
50	0.00632	-24.10282	-15.03337	-0.02051	-0.23030	0.11765	0.23557	0.68392
60	0.00620	-34.12379	-21.70555	-0.02035	-0.22872	0.11681	0.23264	0.68822
70	0.00613	-45.96091	-29.59179	-0.02026	-0.22776	0.11629	0.23085	0.69085
80	0.00608	-59.61600	-38.69180	-0.02019	-0.22713	0.11596	0.22968	0.69257
90	0.00605	-75.08996	-49.00544	-0.02015	-0.22669	0.11573	0.22887	0.69375
100	0.00602	-92.38325	-60.53263	-0.02012	-0.22638	0.11556	0.22829	0.69460

Table 4.3g: Numerical values of displacements and stresses for CCCC thick anisotropic rectangular plate for 90^0 @ α = 5 to 100, β = 1.5

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.02928	-0.86536	-0.18900	-0.00614	-0.02304	0.07059	0.38841	0.33632
10	0.01567	-2.23110	-0.66621	-0.00401	-0.01995	0.04962	0.26409	0.56314
20	0.00942	-5.66990	-2.65774	-0.00261	-0.01955	0.03708	0.17394	0.71970
30	0.00789	-10.80733	-6.00181	-0.00224	-0.01953	0.03381	0.14954	0.76172
40	0.00731	-17.88379	-10.68839	-0.00210	-0.01953	0.03256	0.14015	0.77786
50	0.00704	-26.94679	-16.71547	-0.00203	-0.01953	0.03196	0.13564	0.78561
60	0.00689	-38.00970	-24.08249	-0.00200	-0.01953	0.03163	0.13315	0.78989
70	0.00680	-51.07738	-32.78925	-0.00197	-0.01953	0.03143	0.13162	0.79250
80	0.00674	-66.15193	-42.83566	-0.00196	-0.01953	0.03130	0.13063	0.79421
90	0.00670	-83.23435	-54.22168	-0.00195	-0.01953	0.03121	0.12995	0.79538
100	0.00667	-102.3252	-66.94729	-0.00194	-0.01953	0.03114	0.12946	0.79623

Table 4.4a: Numerical values of displacements and stresses for CSSS thick anisotropic rectangular plate for 0^0 @ α = 5 to 100, β = 1

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.04028	-0.2879082	-0.14667	0.883534	0.07923	0.06058	0.53485	0.032836
10	0.02287	-1.0524095	-0.41132	0.803656	0.05739	0.04737	0.61669	0.027617
20	0.01777	-4.1191859	-1.37990	0.784658	0.04924	0.04267	0.64438	0.024951
30	0.01678	0.07022	-9.23268	-2.98003	0.78127	0.04754	0.04170	0.649992
40	0.01643	-16.391940	-5.21807	0.780106	0.04693	0.04136	0.65199	0.024142
50	0.01627	-25.596803	-8.09496	0.779567	0.04665	0.04120	0.65293	0.024040
60	0.01618	-36.847231	-11.6109	0.779275	0.04649	0.04111	0.65344	0.023985
70	0.01613	-50.143211	-15.7660	0.779099	0.04640	0.04105	0.65375	0.023951
80	0.01609	-65.484736	-20.5603	0.778984	0.04634	0.04102	0.65395	0.023929
90	0.01607	-82.871804	-25.9938	0.778906	0.04629	0.04100	0.65408	0.023914
100	0.01605	-102.30441	-32.0665	0.778850	0.04626	0.04098	0.65418	0.023903

Table 4.4b: Numerical values of displacements and stresses for CSSS thick anisotropic rectangular plate for 15^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.02863	-0.2118946	-0.0844579	0.628712	0.09009	0.15218	0.36933	0.035222
10	0.01788	-0.8258371	-0.2870444	0.603874	0.08201	0.13764	0.47744	0.042298
20	0.01420	-3.2904025	-1.0618537	0.597277	0.07889	0.13194	0.51578	0.044311
30	0.01345	-7.4003147	-2.3472065	0.596086	0.07823	0.13073	0.52361	0.044687
40	0.01319	-13.154581	-4.1457793	0.595674	0.07799	0.13030	0.52641	0.044818
50	0.01307	-20.553036	-6.4579677	0.595484	0.07788	0.13010	0.52772	0.044879
60	0.01300	-29.595637	-9.2838741	0.595381	0.07782	0.12999	0.52843	0.044912
70	0.01296	-40.282368	-12.623534	0.595319	0.07779	0.12992	0.52886	0.044932
80	0.01293	-52.613223	-16.476963	0.595278	0.07776	0.12987	0.52915	0.044945
90	0.01291	-66.588197	-20.844168	0.595251	0.07775	0.12985	0.52934	0.044954
100	0.01290	-82.207290	-25.725152	0.595231	0.07774	0.12982	0.52948	0.044960

Table 4.4c: Numerical values of displacements and stresses for CSSS thick anisotropic rectangular plate for 30^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.01935	-0.1853714	-0.0293180	0.391128	0.1404360	0.21969	0.18630	0.040454
10	0.01301	-0.6388130	-0.1544208	0.366880	0.1376424	0.22288	0.29064	0.063455
20	0.01012	-2.3655269	-0.6863956	0.355687	0.1363570	0.22436	0.33804	0.073954
30	0.00948	-5.2270856	-1.5789329	0.353188	0.1360703	0.22470	0.34858	0.076291
40	0.00924	-9.2306634	-2.8294302	0.352275	0.1359655	0.22482	0.35242	0.077144
50	0.00913	-14.377371	-4.4374842	0.351845	0.1359162	0.22487	0.35423	0.077545
60	0.00907	-20.667500	-6.4029896	0.351609	0.1358892	0.22491	0.35522	0.077765
70	0.00904	-28.101152	-8.7259090	0.351467	0.1358729	0.22493	0.35582	0.077898
80	0.00901	-36.678371	-11.406227	0.351374	0.1358623	0.22494	0.35621	0.077985
90	0.00900	-46.399178	-14.443936	0.351310	0.1358549	0.22495	0.35648	0.078044
100	0.00898	-57.263583	-17.839031	0.351265	0.1358497	0.22495	0.35667	0.078087

Table 4.4d: Numerical values of displacements and stresses for CSSS thick anisotropic rectangular plate for 45^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.018890	-0.25064	-0.010815	0.246687	0.22180	0.29169	0.077386	0.05018
10	0.012191	-0.67033	-0.103656	0.220011	0.21233	0.25615	0.164876	0.08410
20	0.008675	-2.07744	-0.524205	0.207856	0.20800	0.23997	0.215036	0.10187
30	0.007844	-4.36691	-1.235198	0.205104	0.20701	0.23631	0.227158	0.10607
40	0.007536	-7.56285	-2.232276	0.204094	0.20665	0.23496	0.231674	0.10762
50	0.007391	-11.6691	-3.514726	0.203617	0.20648	0.23433	0.233816	0.10836
60	0.007311	-16.6869	-5.082357	0.203356	0.20639	0.23398	0.234993	0.10876
70	0.007262	-22.6165	-6.935102	0.203197	0.20633	0.23377	0.235708	0.10901
80	0.007230	-29.4581	-9.072932	0.203094	0.20629	0.23363	0.236174	0.10917
90	0.007209	-37.2118	-11.49583	0.203024	0.20627	0.23354	0.236494	0.10928
100	0.007193	-45.8776	-14.20380	0.202973	0.20625	0.23347	0.236724	0.10936

Table 4.4e: Numerical values of displacements and stresses for CSSS thick anisotropic rectangular plate for 60^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.024778	-0.367154	-0.018296	0.15552	0.3341	0.3349	0.04394	0.06335
10	0.014592	-0.869051	-0.109497	0.12911	0.3139	0.2398	0.09721	0.10940
20	0.009167	-2.261338	-0.510150	0.11554	0.3030	0.1915	0.12807	0.13391
30	0.007880	-4.448783	-1.185593	0.11235	0.3004	0.1801	0.13554	0.13973
40	0.007403	-7.488592	-2.132519	0.11117	0.2995	0.1759	0.13833	0.14189
50	0.007177	-11.39030	-3.350375	0.11061	0.2990	0.1739	0.13965	0.14291
60	0.007053	-16.15646	-4.839017	0.11031	0.2988	0.1729	0.14038	0.14347
70	0.006978	-21.78798	-6.598390	0.11012	0.2986	0.1722	0.14082	0.14381
80	0.006929	-28.28524	-8.628474	0.11000	0.2985	0.1718	0.14111	0.14403
90	0.006895	-35.64842	-10.92926	0.10991	0.2985	0.1715	0.14130	0.14418
100	0.006871	-43.87763	-13.50073	0.10986	0.2984	0.1713	0.14144	0.14429

Table 4.4f: Numerical values of displacements and stresses for CSSS thick anisotropic rectangular plate for 75^0 @ α = 5 to 100, P = 1

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.040700	-0.610174	-0.044000	0.119978	0.5903	0.23703	0.06153	0.09569
10	0.020101	-1.244959	-0.155080	0.074704	0.4733	0.13739	0.06225	0.14816
20	0.010897	-2.749376	-0.585533	0.053811	0.4216	0.09120	0.06045	0.17174
30	0.008863	-5.065384	-1.300480	0.049156	0.4101	0.08089	0.05993	0.17696
40	0.008122	-8.277380	-2.301017	0.047457	0.4060	0.07713	0.05973	0.17886
50	0.007774	-12.39835	-3.587309	0.046658	0.4040	0.07536	0.05964	0.17976
60	0.007583	-17.43169	-5.159401	0.046220	0.4030	0.07439	0.05959	0.18025
70	0.007468	-23.37860	-7.017308	0.045955	0.4023	0.07381	0.05956	0.18054
80	0.007392	-30.23957	-9.161036	0.045783	0.4019	0.07342	0.05953	0.18073
90	0.007341	-38.01485	-11.59059	0.045664	0.4016	0.07316	0.05952	0.18087
100	0.007304	-46.70457	-14.30597	0.045579	0.4014	0.07297	0.05951	0.18096

Table 4.4g: Numerical values of displacements and stresses for CSSS thick anisotropic rectangular plate for 90^0 @ α = 5 to 100, β = 1

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.058215	-0.874109	-0.070395	0.113624	0.8731	0.08794	0.08599	0.1324
10	0.024355	-1.528522	-0.192695	0.051766	0.5910	0.04290	0.04529	0.1766
20	0.012066	-3.0698975	-0.643468	0.027920	0.4895	0.02564	0.02834	0.1930
30	0.009536	-5.4762530	-1.389039	0.022942	0.4687	0.02204	0.02474	0.1964
40	0.008630	-8.8210799	-2.431995	0.021152	0.4612	0.02075	0.02344	0.1976
50	0.008206	-13.114780	-3.772700	0.020316	0.4578	0.02014	0.02284	0.1982
60	0.007975	-18.360012	-5.411247	0.019859	0.4559	0.01982	0.02251	0.1985
70	0.007836	-24.557701	-7.347670	0.019583	0.4547	0.01962	0.02230	0.1987
80	0.007745	-31.708235	-9.581981	0.019403	0.4540	0.01949	0.02217	0.1988
90	0.007683	-39.811801	-12.11419	0.019280	0.4534	0.01940	0.02208	0.1989
100	0.007638	-48.86850	-14.94429	0.019192	0.4531	0.01933	0.02202	0.1990

Table 4.5a: Numerical values of displacements and stresses for CCSS thick anisotropic rectangular plate for 0^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.075423	-0.0497670	-0.111938	0.666032	0.27531	0.05174	0.15161	0.02334
10	0.034458	-0.1572884	-0.249011	0.510493	0.15451	0.03250	0.17756	0.01599
20	0.022097	-0.5827305	-0.686461	0.463950	0.10760	0.02538	0.18655	0.01238
30	0.019680	-1.2913309	-1.397620	0.454874	0.09772	0.02390	0.18839	0.01158
40	0.018823	-2.2833103	-2.390524	0.451661	0.09416	0.02336	0.18905	0.01129
50	0.018425	-3.5586959	-3.666343	0.450167	0.09249	0.02312	0.18935	0.01115
60	0.018208	-5.1174941	-5.225377	0.449354	0.09158	0.02298	0.18952	0.01108
70	0.018077	-6.959707	-7.067734	0.448864	0.09103	0.02290	0.18962	0.01103
80	0.017992	-9.0853361	-9.193455	0.448544	0.09067	0.02284	0.18969	0.01100
90	0.017933	-11.494381	-11.60256	0.448325	0.09042	0.02281	0.18973	0.01098
100	0.017892	-14.186843	-14.29507	0.448168	0.09025	0.02278	0.18977	0.01097

Table 4.5b: Numerical values of displacements and stresses for CCSS thick anisotropic rectangular plate for 15^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.059261	-0.0391076	-0.077668	0.707844	0.2429	0.14743	0.1191	0.02451
10	0.030130	-0.1389965	-0.198180	0.552768	0.1629	0.10642	0.1530	0.02571
20	0.020234	-0.537259	-0.605679	0.494929	0.1301	0.09018	0.1653	0.02507
30	0.018238	-1.2012387	-1.271702	0.482849	0.1231	0.08672	0.1678	0.02486
40	0.017526	-2.1308625	-2.202070	0.478503	0.1205	0.08547	0.1687	0.02477
50	0.017194	-3.3261095	-3.397667	0.476470	0.1193	0.08489	0.1691	0.02473
60	0.017014	-4.7869736	-4.858723	0.475360	0.1187	0.08457	0.1694	0.02471
70	0.016904	-6.5134524	-6.585318	0.474689	0.1183	0.08437	0.1695	0.02470
80	0.016833	-8.5055450	-8.577486	0.474252	0.1180	0.08425	0.1696	0.02469
90	0.016785	-10.763251	-10.83524	0.473952	0.1178	0.08416	0.1697	0.02468
100	0.016750	-13.286570	-13.35860	0.473738	0.1177	0.08410	0.1697	0.02468

Table 4.5c: Numerical values of displacements and stresses for CCSS thick anisotropic rectangular plate for 30^0 @ α = 5 to 100, β = 1

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.041706	-0.031460	-0.038895	0.634902	0.3056	0.2214	0.07792	0.02671
10	0.024712	-0.123542	-0.125618	0.549442	0.2585	0.1960	0.11122	0.04324
20	0.017584	-0.479786	-0.477029	0.526084	0.2468	0.1882	0.12434	0.05139
30	0.016042	-1.070271	-1.066225	0.522214	0.2450	0.1868	0.12710	0.05326
40	0.015483	-1.896366	-1.891828	0.520923	0.2445	0.1863	0.12809	0.05396
50	0.015220	-2.958313	-2.953541	0.520337	0.2442	0.1860	0.12856	0.05428
60	0.015077	-4.256181	-4.251280	0.520023	0.2441	0.1859	0.12881	0.05446
70	0.014990	-5.789993	-5.785013	0.519835	0.2440	0.1858	0.12896	0.05457
80	0.014933	-7.559759	-7.554727	0.519713	0.2439	0.1858	0.12906	0.05464
90	0.014894	-9.565484	-9.560416	0.519630	0.2439	0.1858	0.12913	0.05469
100	0.014867	-11.80717	-11.80208	0.519571	0.2439	0.1857	0.12918	0.05472

Table 4.5d: Numerical values of displacements and stresses for CCSS thick anisotropic rectangular plate for 45^0 @ α = 5 to 100, β = 1

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.038076	-0.0407295	-0.02046674	0.426572	0.4561	0.2503	0.05313	0.03341
10	0.024321	-0.143545	-0.08909189	0.437324	0.4735	0.2378	0.07653	0.06328
20	0.017162	-0.4917397	-0.41351434	0.472688	0.5199	0.2314	0.08615	0.08139
30	0.015453	-1.0538326	-0.96940990	0.483741	0.5343	0.2298	0.08822	0.08594
40	0.014818	-1.8373337	-1.75055611	0.488094	0.5399	0.2293	0.08897	0.08765
50	0.014516	-2.8436617	-2.75575859	0.490202	0.5426	0.2290	0.08932	0.08847
60	0.014350	-4.0732095	-3.98468533	0.491373	0.5442	0.2288	0.08952	0.08892
70	0.014250	-5.5261187	-5.43721665	0.492088	0.5451	0.2287	0.08963	0.08919
80	0.014184	-7.2024499	-7.11330121	0.492556	0.5457	0.2287	0.08971	0.08937
90	0.014139	-9.1022325	-9.01291409	0.492879	0.5461	0.2286	0.08976	0.08949
100	0.014107	-11.225482	-11.1360420	0.493111	0.5464	0.2286	0.08980	0.08958

Table 4.5e: Numerical values of displacements and stresses for CCSS thick anisotropic rectangular plate for 60^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.049301	-0.0708417	-0.01958717	0.298258	0.8184	0.2846	0.04164	0.04740
10	0.030425	-0.2087664	-0.09332140	0.318510	0.9126	0.2377	0.05194	0.09004
20	0.019736	-0.5953344	-0.43721108	0.345753	1.0227	0.2031	0.05432	0.11660
30	0.017085	-1.1936887	-1.02450190	0.353702	1.0543	0.1939	0.05465	0.12337
40	0.016088	-2.0227734	-1.84938437	0.356795	1.0666	0.1904	0.05476	0.12593
50	0.015613	-3.0861507	-2.91075338	0.358286	1.0725	0.1887	0.05480	0.12716
60	0.015352	-4.3848077	-4.20830195	0.359112	1.0757	0.1878	0.05482	0.12783
70	0.015193	-5.9190995	-5.74191946	0.359617	1.0777	0.1872	0.05484	0.12824
80	0.015089	-7.6891787	-7.51155844	0.359946	1.0790	0.1869	0.05485	0.12851
90	0.015018	-9.6951190	-9.51719586	0.360173	1.0799	0.1866	0.05485	0.12869
100	0.014967	-11.936960	-11.7588195	0.360336	1.0806	0.1864	0.05486	0.12882

Table 4.5f: Numerical values of displacements and stresses for CCSS thick anisotropic rectangular plate for 75^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.083515	-0.138987	-0.037234	0.2269	2.03983	0.22249	0.04206	0.07787
10	0.044118	-0.329855	-0.136097	0.1837	1.83701	0.14707	0.03463	0.13010
20	0.024898	-0.778114	-0.533857	0.1631	1.78198	0.10352	0.02795	0.15773
30	0.020438	-1.454045	-1.197717	0.1583	1.77194	0.09300	0.02621	0.16428
40	0.018790	-2.388111	-2.127296	0.1566	1.76846	0.08907	0.02555	0.16671
50	0.018011	-3.585463	-3.322522	0.1558	1.76685	0.08721	0.02523	0.16785
60	0.017584	-5.047483	-4.783374	0.1553	1.76598	0.08619	0.02506	0.16849
70	0.017325	-6.774664	-6.509846	0.1550	1.76545	0.08557	0.02496	0.16887
80	0.017156	-8.767214	-8.501934	0.1548	1.76511	0.08516	0.02489	0.16912
90	0.017040	-11.02523	-10.75963	0.1547	1.76488	0.08489	0.02484	0.16929
100	0.016957	-13.54877	-13.28295	0.1546	1.76471	0.08469	0.02481	0.16941

Table 4.5g: Numerical values of displacements and stresses for CCSS thick anisotropic rectangular plate for 90^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.121540	-0.212513	-0.0589611	0.137727	3.5721	0.08687	0.04584	0.1104
10	0.054994	-0.422891	-0.1739680	0.077035	2.6287	0.04774	0.02559	0.1595
20	0.028275	-0.894642	-0.6028641	0.049571	2.2731	0.02995	0.01525	0.1811
30	0.022529	-1.613479	-1.3122323	0.043492	2.1979	0.02600	0.01290	0.1859
40	0.020447	-2.609189	-2.3044920	0.041277	2.1707	0.02456	0.01204	0.1876
50	0.019470	-3.886329	-3.5800092	0.040235	2.1580	0.02389	0.01164	0.1884
60	0.018936	-5.446087	-5.1388796	0.039665	2.1511	0.02352	0.01141	0.1888
70	0.018613	-7.288882	-6.9811364	0.039319	2.1469	0.02329	0.01128	0.1891
80	0.018403	-9.414889	-9.1067938	0.039095	2.1441	0.02315	0.01119	0.1893
90	0.018259	-11.82419	-11.515859	0.038940	2.1423	0.02305	0.01113	0.1894
100	0.018155	-14.51684	-14.208334	0.038830	2.1409	0.02298	0.01109	0.1895

Table 4.6a: Numerical values of displacements and stresses for CSCS thick anisotropic rectangular plate for 0^0 @ α = 5 to 100, β = 1.5

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00266	-0.02646	-0.05007	-0.00458	-0.00027	0.00624	0.11327	0.01074
10	0.00094	-0.06329	-0.08725	-0.00273	-0.00013	0.00298	0.12269	0.00569
20	0.00047	-0.20690	-0.18794	-0.00223	-0.00008	0.00188	0.12565	0.00350
30	0.00038	-0.44581	-0.34826	-0.00213	-0.00007	0.00165	0.12624	0.00303
40	0.00035	-0.78023	-0.57159	-0.00210	-0.00006	0.00157	0.12645	0.00286
50	0.00034	-1.21017	-0.85839	-0.00208	-0.00006	0.00153	0.12655	0.00278
60	0.00033	-1.73566	-1.20881	-0.00207	-0.00006	0.00151	0.12660	0.00274
70	0.00032	-2.35668	-1.62289	-0.00207	-0.00006	0.00150	0.12663	0.00271
80	0.00032	-3.07325	-2.10064	-0.00206	-0.00006	0.00149	0.12665	0.00269
90	0.00032	-3.88536	-2.64207	-0.00206	-0.00006	0.00149	0.12667	0.00268
100	0.00032	-4.79300	-3.24718	-0.00206	-0.00006	0.00148	0.12668	0.00267

Table 4.6b: Numerical values of displacements and stresses for CSCS thick anisotropic rectangular plate for 15^0 @ $\alpha = 5$ to 100, $\beta = 1.5$

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00360	-0.03413	-0.06239	-0.06376	-0.00550	0.03238	0.15637	0.01791
10	0.00103	-0.06958	-0.08799	-0.02573	-0.00220	0.01292	0.13254	0.01038
20	0.00051	-0.22519	-0.19392	-0.01689	-0.00144	0.00838	0.12805	0.00787
30	0.00041	-0.48570	-0.36813	-0.01523	-0.00129	0.00752	0.12729	0.00735
40	0.00038	-0.85056	-0.61157	-0.01465	-0.00124	0.00722	0.12702	0.00715
50	0.00037	-1.31971	-0.92443	-0.01438	-0.00122	0.00708	0.12690	0.00707
60	0.00036	-1.89313	-1.30677	-0.01423	-0.00120	0.00700	0.12684	0.00702
70	0.00035	-2.57082	-1.75859	-0.01414	-0.00120	0.00696	0.12680	0.00699
80	0.00035	-3.35277	-2.27991	-0.01408	-0.00119	0.00693	0.12677	0.00697
90	0.00035	-4.23898	-2.87073	-0.01404	-0.00119	0.00691	0.12676	0.00695
100	0.00035	-5.22946	-3.53106	-0.01401	-0.00118	0.00689	0.12674	0.00694

Table 4.6c: Numerical values of displacements and stresses for CSCS thick anisotropic rectangular plate for 30^0 @ $\alpha = 5$ to 100, $\beta = 1.5$

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.01296	-0.10818	-0.18543	-0.26033	-0.08977	0.24145	0.58426	0.08782
10	0.00128	-0.09210	-0.08813	-0.03841	-0.01321	0.03538	0.15600	0.02556
20	0.00061	-0.28981	-0.21367	-0.02634	-0.00904	0.02417	0.13151	0.02279
30	0.00051	-0.62475	-0.43583	-0.02457	-0.00843	0.02253	0.12776	0.02247
40	0.00048	-1.09422	-0.74842	-0.02398	-0.00823	0.02198	0.12649	0.02237
50	0.00046	-1.69796	-1.15073	-0.02371	-0.00813	0.02173	0.12591	0.02232
60	0.00046	-2.43593	-1.64260	-0.02356	-0.00808	0.02160	0.12560	0.02230
70	0.00045	-3.30809	-2.22399	-0.02348	-0.00805	0.02152	0.12541	0.02229
80	0.00045	-4.31445	-2.89485	-0.02342	-0.00803	0.02147	0.12529	0.02228
90	0.00045	-5.45500	-3.65519	-0.02338	-0.00802	0.02143	0.12520	0.02227
100	0.00044	-6.72973	-4.50499	-0.02335	-0.00801	0.02141	0.12514	0.02227

Table 4.6d: Numerical values of displacements and stresses for CSCS thick anisotropic rectangular plate for 45^0 @ α = 5 to 100, β = 1.5

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	-0.0487	0.39615	0.52882	0.62017	0.61987	-0.96480	-2.2093	-0.4303
10	0.00165	-0.14238	-0.08431	-0.03544	-0.03530	0.05482	0.16636	0.05073
20	0.00084	-0.43403	-0.25813	-0.02706	-0.02695	0.04186	0.12599	0.05233
30	0.00073	-0.92252	-0.57799	-0.02619	-0.02609	0.04053	0.11969	0.05413
40	0.00069	-1.60550	-1.03102	-0.02594	-0.02584	0.04015	0.11751	0.05493
50	0.00067	-2.48326	-1.61507	-0.02584	-0.02574	0.03999	0.11650	0.05533
60	0.00066	-3.55592	-2.32955	-0.02578	-0.02569	0.03991	0.11596	0.05556
70	0.00065	-4.82353	-3.17424	-0.02575	-0.02565	0.03986	0.11563	0.05570
80	0.00065	-6.28612	-4.14905	-0.02573	-0.02564	0.03983	0.11541	0.05580
90	0.00064	-7.94370	-5.25392	-0.02572	-0.02562	0.03981	0.11527	0.05586
100	0.00064	-9.79626	-6.48884	-0.02571	-0.02561	0.03979	0.11516	0.05591

Table 4.6e: Numerical values of displacements and stresses for CSCS thick anisotropic rectangular plate for 60^0 @ α = 5 to 100, β = 1.5

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.01503	-0.19812	-0.11116	-0.08533	-0.24566	0.22803	0.56847	0.16414
10	0.00217	-0.24213	-0.08748	-0.02186	-0.06272	0.05828	0.13727	0.08097
20	0.00125	-0.70182	-0.34824	-0.01790	-0.05149	0.04780	0.10038	0.09855
30	0.00108	-1.42850	-0.81766	-0.01725	-0.04966	0.04609	0.09252	0.10547
40	0.00102	-2.43498	-1.48248	-0.01702	-0.04903	0.04550	0.08956	0.10839
50	0.00099	-3.72539	-2.33971	-0.01691	-0.04874	0.04523	0.08815	0.10984
60	0.00097	-5.30106	-3.38845	-0.01686	-0.04858	0.04508	0.08737	0.11065
70	0.00096	-7.16248	-4.62834	-0.01682	-0.04848	0.04499	0.08690	0.11116
80	0.00095	-9.30988	-6.05925	-0.01680	-0.04842	0.04493	0.08659	0.11149
90	0.00095	-11.74336	-7.68110	-0.01678	-0.04838	0.04489	0.08637	0.11172
100	0.00095	-14.46300	-9.49385	-0.01677	-0.04835	0.04486	0.08622	0.11188

Table 4.6f: Numerical values of displacements and stresses for CSCS thick anisotropic rectangular plate for 75^0 @ α = 5 to 100, β = 1.5

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00652	-0.15719	-0.03900	-0.00960	-0.10396	0.05376	0.14003	0.07682
10	0.00292	-0.39180	-0.11240	-0.00622	-0.06776	0.03498	0.08479	0.11189
20	0.00174	-1.02721	-0.46534	-0.00476	-0.05276	0.02707	0.05817	0.14719
30	0.00145	-1.96784	-1.07117	-0.00437	-0.04883	0.02499	0.05091	0.15801
40	0.00134	-3.25843	-1.92311	-0.00422	-0.04731	0.02419	0.04807	0.16233
50	0.00129	-4.90941	-3.01965	-0.00415	-0.04658	0.02380	0.04670	0.16443
60	0.00126	-6.92390	-4.36035	-0.00411	-0.04617	0.02358	0.04594	0.16560
70	0.00124	-9.30305	-5.94504	-0.00409	-0.04592	0.02345	0.04548	0.16632
80	0.00123	-12.04735	-7.77365	-0.00407	-0.04576	0.02336	0.04517	0.16679
90	0.00122	-15.15705	-9.84615	-0.00406	-0.04565	0.02330	0.04496	0.16712
100	0.00121	-18.63229	-12.16252	-0.00405	-0.04557	0.02326	0.04481	0.16735

Table 4.6g: Numerical values of displacements and stresses for CSCS thick anisotropic rectangular plate for 90^0 @ α = 5 to 100, β = 1.5

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00619	-0.18283	-0.03792	-0.00129	-0.00464	0.01473	0.08240	0.07235
10	0.00333	-0.47487	-0.13092	-0.00085	-0.00394	0.01031	0.05601	0.12633
20	0.00195	-1.17334	-0.51941	-0.00054	-0.00383	0.00750	0.03566	0.16720
30	0.00160	-2.18527	-1.17228	-0.00045	-0.00382	0.00673	0.02991	0.17872
40	0.00146	-3.57068	-2.08741	-0.00042	-0.00382	0.00643	0.02767	0.18320
50	0.00140	-5.34223	-3.26436	-0.00040	-0.00381	0.00629	0.02659	0.18537
60	0.00136	-7.50357	-4.70298	-0.00039	-0.00381	0.00621	0.02599	0.18657
70	0.00134	-10.05604	-6.40324	-0.00039	-0.00381	0.00616	0.02562	0.18730
80	0.00132	-13.00021	-8.36511	-0.00038	-0.00381	0.00613	0.02538	0.18778
90	0.00131	-16.33635	-10.58859	-0.00038	-0.00381	0.00611	0.02522	0.18811
100	0.00131	-20.06464	-13.07366	-0.00038	-0.00381	0.00609	0.02510	0.18835

Table 4.7a: Numerical values of displacements and stresses for CCCS thick anisotropic rectangular plate for 0^0 @ α = 5 to 100, β = 1.5

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00739	-0.09359	-0.14449	-0.01618	-0.00082	0.01907	0.28550	0.02688
10	0.00315	-0.27657	-0.29406	-0.01191	-0.00045	0.01102	0.31060	0.01702
20	0.00197	-1.00085	-0.78719	-0.01076	-0.00033	0.00838	0.31832	0.01291
30	0.00175	-2.20717	-1.59353	-0.01054	-0.00031	0.00785	0.31984	0.01204
40	0.00167	-3.89591	-2.72012	-0.01046	-0.00030	0.00766	0.32038	0.01173
50	0.00164	-6.06712	-4.16794	-0.01043	-0.00029	0.00757	0.32064	0.01158
60	0.00162	-8.72080	-5.93726	-0.01041	-0.00029	0.00752	0.32077	0.01150
70	0.00160	-11.85697	-8.02816	-0.01040	-0.00029	0.00749	0.32086	0.01145
80	0.00160	-15.47562	-10.44067	-0.01039	-0.00029	0.00747	0.32091	0.01142
90	0.00159	-19.57676	-13.17482	-0.01038	-0.00029	0.00746	0.32095	0.01140
100	0.00159	-24.16039	-16.23061	-0.01038	-0.00029	0.00745	0.32097	0.01138

Table 4.7b: Numerical values of displacements and stresses for CCCS thick anisotropic rectangular plate for 15^0 @ α = 5 to 100, β = 1.5

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00719	-0.09009	-0.12679	-0.14213	-0.01220	0.07162	0.27917	0.03441
10	0.00311	-0.27764	-0.26585	-0.08794	-0.00749	0.04377	0.29959	0.03143
20	0.00200	-1.02385	-0.76899	-0.07194	-0.00609	0.03552	0.30556	0.02963
30	0.00179	-2.26732	-1.59919	-0.06882	-0.00582	0.03390	0.30672	0.02920
40	0.00171	-4.00816	-2.76019	-0.06771	-0.00572	0.03333	0.30713	0.02905
50	0.00168	-6.24639	-4.25255	-0.06719	-0.00568	0.03306	0.30732	0.02898
60	0.00166	-8.98200	-6.07640	-0.06691	-0.00565	0.03292	0.30742	0.02894
70	0.00165	-12.21499	-8.23180	-0.06674	-0.00564	0.03283	0.30749	0.02891
80	0.00164	-15.94536	-10.71876	-0.06663	-0.00563	0.03277	0.30753	0.02890
90	0.00164	-20.17312	-13.53730	-0.06656	-0.00562	0.03274	0.30756	0.02888
100	0.00163	-24.89827	-16.68742	-0.06650	-0.00562	0.03271	0.30758	0.02888

Table 4.7c: Numerical values of displacements and stresses for CCCS thick anisotropic rectangular plate for 30^0 @ α = 5 to 100, β = 1.5

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00682	-0.08919	-0.09305	-0.15631	-0.05376	0.14411	0.25909	0.04894
10	0.00313	-0.30230	-0.21127	-0.10708	-0.03674	0.09820	0.26852	0.06576
20	0.00212	-1.12589	-0.74523	-0.09716	-0.03333	0.08904	0.26954	0.07509
30	0.00193	-2.49183	-1.65207	-0.09565	-0.03281	0.08766	0.26957	0.07738
40	0.00186	-4.40297	-2.92473	-0.09515	-0.03264	0.08720	0.26957	0.07823
50	0.00183	-6.85979	-4.56194	-0.09493	-0.03257	0.08700	0.26956	0.07864
60	0.00182	-9.86244	-6.56333	-0.09481	-0.03253	0.08689	0.26956	0.07886
70	0.00181	-13.41095	-8.92878	-0.09474	-0.03250	0.08682	0.26955	0.07900
80	0.00180	-17.50536	-11.65823	-0.09469	-0.03249	0.08678	0.26955	0.07909
90	0.00179	-22.14567	-14.75167	-0.09466	-0.03247	0.08675	0.26955	0.07915
100	0.00179	-27.33189	-18.20908	-0.09464	-0.03247	0.08673	0.26955	0.07919

Table 4.7d: Numerical values of displacements and stresses for CCCS thick anisotropic rectangular plate for 45^0 @ α = 5 to 100, β = 1.5

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00688	-0.11370	-0.06269	-0.10966	-0.10917	0.16953	0.22555	0.06801
10	0.00356	-0.39827	-0.17757	-0.08797	-0.08749	0.13579	0.22233	0.11205
20	0.00249	-1.38827	-0.78340	-0.08454	-0.08417	0.13072	0.21553	0.14274
30	0.00227	-2.99344	-1.83874	-0.08421	-0.08387	0.13028	0.21345	0.15105
40	0.00219	-5.23181	-3.32529	-0.08412	-0.08380	0.13018	0.21264	0.15425
50	0.00215	-8.10701	-5.23935	-0.08409	-0.08377	0.13015	0.21224	0.15579
60	0.00213	-11.62005	-7.57986	-0.08407	-0.08376	0.13013	0.21202	0.15664
70	0.00211	-15.77132	-10.34645	-0.08407	-0.08376	0.13012	0.21189	0.15716
80	0.00211	-20.56097	-13.53894	-0.08406	-0.08375	0.13012	0.21180	0.15750
90	0.00210	-25.98908	-17.15727	-0.08406	-0.08375	0.13012	0.21174	0.15774
100	0.00210	-32.05569	-21.20138	-0.08405	-0.08375	0.13011	0.21170	0.15790

Table 4.7e: Numerical values of displacements and stresses for CCCS thick anisotropic rectangular plate for 60^0 @ α = 5 to 100, β = 1.5

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00848	-0.20064	-0.05253	-0.06553	-0.18753	0.17437	0.18746	0.09873
10	0.00483	-0.62938	-0.20130	-0.05457	-0.15638	0.14535	0.16807	0.17579
20	0.00326	-1.90426	-0.95039	-0.04869	-0.14005	0.13003	0.14968	0.23138
30	0.00288	-3.89192	-2.24765	-0.04718	-0.13586	0.12610	0.14440	0.24668
40	0.00274	-6.64708	-4.07364	-0.04660	-0.13427	0.12460	0.14234	0.25260
50	0.00268	-10.18097	-6.42437	-0.04633	-0.13350	0.12388	0.14134	0.25546
60	0.00264	-14.49677	-9.29870	-0.04618	-0.13308	0.12349	0.14079	0.25704
70	0.00262	-19.59566	-12.69620	-0.04608	-0.13282	0.12325	0.14045	0.25800
80	0.00260	-25.47813	-16.61670	-0.04602	-0.13266	0.12309	0.14023	0.25863
90	0.00259	-32.14443	-21.06011	-0.04598	-0.13254	0.12298	0.14008	0.25906
100	0.00258	-39.59470	-26.02639	-0.04595	-0.13246	0.12290	0.13997	0.25937

Table 4.7f: Numerical values of displacements and stresses for CCCS thick anisotropic rectangular plate for 75^0 @ α = 5 to 100, β = 1.5

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.01318	-0.40361	-0.07907	-0.02330	-0.25044	0.12985	0.15375	0.15500
10	0.00725	-1.03894	-0.30094	-0.01655	-0.18024	0.09303	0.11178	0.26482
20	0.00439	-2.64476	-1.24564	-0.01245	-0.13817	0.07086	0.08263	0.33255
30	0.00371	-5.07751	-2.83545	-0.01141	-0.12756	0.06526	0.07507	0.34975
40	0.00345	-8.43853	-5.06403	-0.01102	-0.12355	0.06315	0.07220	0.35625
50	0.00333	-12.74643	-7.93018	-0.01083	-0.12164	0.06214	0.07082	0.35935
60	0.00326	-18.00633	-11.43360	-0.01073	-0.12058	0.06158	0.07007	0.36106
70	0.00322	-24.22007	-15.57415	-0.01067	-0.11994	0.06124	0.06961	0.36210
80	0.00320	-31.38844	-20.35180	-0.01063	-0.11952	0.06102	0.06931	0.36278
90	0.00318	-39.51183	-25.76652	-0.01060	-0.11924	0.06087	0.06910	0.36324
100	0.00317	-48.59043	-31.81830	-0.01058	-0.11903	0.06076	0.06895	0.36358

Table 4.7g: Numerical values of displacements and stresses for CCCS thick anisotropic rectangular plate for 90^0 @ α = 5 to 100, β = 1.5

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.01785	-0.59585	-0.11448	-0.00421	-0.01408	0.04716	0.13445	0.20550
10	0.00903	-1.33321	-0.38354	-0.00239	-0.01151	0.02931	0.07997	0.32449
20	0.00507	-3.07981	-1.43011	-0.00142	-0.01052	0.02006	0.04904	0.38693
30	0.00416	-5.72872	-3.16822	-0.00119	-0.01031	0.01789	0.04163	0.40166
40	0.00383	-9.39266	-5.60052	-0.00110	-0.01023	0.01708	0.03888	0.40712
50	0.00368	-14.09040	-8.72746	-0.00106	-0.01020	0.01670	0.03758	0.40970
60	0.00359	-19.82697	-12.54916	-0.00104	-0.01018	0.01649	0.03686	0.41112
70	0.00354	-26.60416	-17.06566	-0.00103	-0.01016	0.01636	0.03642	0.41198
80	0.00350	-34.42272	-22.27698	-0.00102	-0.01016	0.01628	0.03614	0.41254
90	0.00348	-43.28303	-28.18312	-0.00101	-0.01015	0.01622	0.03595	0.41292
100	0.00346	-53.18527	-34.78409	-0.00101	-0.01015	0.01618	0.03581	0.41320

Table 4.8a: Numerical values of displacements and stresses for SSFS thick anisotropic rectangular plate for 0^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.01617	-0.28878	-0.24675	0.87371	0.02952	-0.01302	0.53721	0.00732
10	0.00832	-0.96153	-0.52054	0.72570	0.01822	-0.00813	0.55416	0.00734
20	0.00628	-3.64489	-1.59581	0.68723	0.01527	-0.00686	0.55856	0.00733
30	0.00590	-8.11636	-3.38588	0.68004	0.01472	-0.00662	0.55938	0.00733
40	0.00576	-14.3763	-5.89169	0.67752	0.01453	-0.00654	0.55967	0.00733
50	0.00570	-22.4248	-9.11339	0.67635	0.01444	-0.00650	0.55981	0.00733
60	0.00567	-32.2618	-13.0510	0.67572	0.01439	-0.00648	0.55988	0.00733
70	0.00565	-43.8874	-17.7045	0.67534	0.01436	-0.00647	0.55992	0.00733
80	0.00563	-57.3015	-23.0739	0.67509	0.01434	-0.00646	0.55995	0.00733
90	0.00562	-72.5042	-29.1593	0.67492	0.01433	-0.00645	0.55997	0.00733
100	0.00562	-89.4954	-35.9605	0.67480	0.01432	-0.00645	0.55998	0.00733

Table 4.8b: Numerical values of displacements and stresses for SSFS thick anisotropic rectangular plate for 15^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.01559	-0.27899	-0.2290	0.7691	0.07971	-0.04830	0.51676	0.01232
10	0.00831	-0.97472	-0.4926	0.6606	0.06223	-0.03129	0.53199	0.02369
20	0.00641	-3.74574	-1.5963	0.6319	0.05800	-0.02743	0.53617	0.02769
30	0.00606	-8.36260	-3.4432	0.6265	0.05723	-0.02674	0.53697	0.02850
40	0.00593	-14.8260	-6.0299	0.6246	0.05696	-0.02650	0.53725	0.02879
50	0.00587	-23.1360	-9.3561	0.6238	0.05684	-0.02639	0.53738	0.02892
60	0.00584	-33.2926	-13.422	0.6233	0.05677	-0.02633	0.53745	0.02900
70	0.00582	-45.2960	-18.2261	0.6230	0.05673	-0.02630	0.53749	0.02904
80	0.00581	-59.1459	-23.7700	0.6228	0.05671	-0.02627	0.53752	0.02907
90	0.00580	-74.8425	-30.0530	0.6227	0.05669	-0.02626	0.53754	0.02909
100	0.00580	-92.3858	-37.0752	0.6226	0.05667	-0.02625	0.53755	0.02911

Table 4.8c Numerical values of displacements and stresses for SSFS thick anisotropic rectangular plate for 30^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.01472	-0.2752	-0.1994	0.5616	0.19785	-0.10941	0.47059	0.02181
10	0.00868	-1.0711	-0.4570	0.5150	0.17503	-0.07826	0.47624	0.05929
20	0.00705	-4.1919	-1.6788	0.5012	0.16975	-0.07415	0.48059	0.07644
30	0.00674	-9.3814	-3.7500	0.4984	0.16880	-0.07368	0.48164	0.08026
40	0.00663	-16.6450	-6.6552	0.4975	0.16847	-0.07354	0.48203	0.08166
50	0.00658	-25.9832	-10.3921	0.4970	0.16832	-0.07349	0.48222	0.08232
60	0.00655	-37.3965	-14.9600	0.4968	0.16824	-0.07346	0.48232	0.08268
70	0.00653	-50.8847	-20.3587	0.4966	0.16819	-0.07344	0.48238	0.08290
80	0.00652	-66.4480	-26.5882	0.4965	0.16816	-0.07343	0.48242	0.08304
90	0.00651	-84.0865	-33.6484	0.4964	0.16814	-0.07342	0.48245	0.08314
100	0.00651	-103.800	-41.5392	0.4964	0.16812	-0.07341	0.48247	0.08321

Table 4.8d: Numerical values of displacements and stresses for SSFS thick anisotropic rectangular plate for 45^0 @ $\alpha = 5$ to 100, $\beta = 1$

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.01529	-0.3397	-0.1725	0.3803	0.35407	-0.14167	0.40774	0.04335
10	0.01043	-1.3969	-0.4924	0.3629	0.33141	-0.12073	0.40722	0.10525
20	0.00894	-5.4423	-2.0619	0.3581	0.32818	-0.12171	0.41459	0.13632
30	0.00863	-12.1479	-4.7345	0.3572	0.32778	-0.12243	0.41662	0.14355
40	0.00852	-21.5295	-8.4855	0.3569	0.32766	-0.12273	0.41740	0.14621
50	0.00847	-33.5898	-13.3111	0.3567	0.32761	-0.12288	0.41777	0.14747
60	0.00844	-48.3295	-19.2100	0.3566	0.32758	-0.12296	0.41798	0.14817
70	0.00842	-65.7488	-26.1819	0.3566	0.32756	-0.12301	0.41810	0.14859
80	0.00841	-85.8479	-34.2268	0.3565	0.32755	-0.12305	0.41818	0.14886
90	0.00840	-108.627	-43.3444	0.3565	0.32754	-0.12307	0.41824	0.14905
100	0.00840	-134.085	-53.5348	0.3565	0.32754	-0.12309	0.41828	0.14918

Table 4.8e: Numerical values of displacements and stresses for SSFS thick anisotropic rectangular plate for 60^0 @ $\alpha = 5$ to 100, $\beta = 1$

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.02051	-0.5976	-0.1742	0.2549	0.54942	-0.14611	0.33395	0.09249
10	0.01581	-2.2994	-0.7327	0.2513	0.54772	-0.14606	0.34637	0.16808
20	0.01410	-8.7836	-3.2709	0.2516	0.55942	-0.14991	0.35605	0.20402
30	0.01373	-19.5289	-7.5591	0.2518	0.56260	-0.15095	0.35841	0.21217
40	0.01359	-34.5624	-13.5720	0.2518	0.56381	-0.15135	0.35928	0.21516
50	0.01353	-53.8883	-21.3055	0.2519	0.56439	-0.15153	0.35970	0.21656
60	0.01350	-77.5077	-30.7587	0.2519	0.56471	-0.15164	0.35992	0.21733
70	0.01348	-105.4209	-41.9311	0.2519	0.56490	-0.15170	0.36006	0.21780
80	0.01346	-137.6283	-54.8226	0.2519	0.56503	-0.15174	0.36015	0.21811
90	0.01345	-174.1298	-69.4331	0.2519	0.56511	-0.15177	0.36022	0.21832
100	0.01345	-214.9255	-85.7626	0.2519	0.56517	-0.15179	0.36026	0.21847

Table 4.8f: Numerical values of displacements and stresses for SSFS thick anisotropic rectangular plate for 75^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.03971	-1.3871	-0.3297	0.2378	0.89709	-0.12545	0.30178	0.18362
10	0.03212	-4.9353	-1.6135	0.2275	1.00174	-0.12720	0.30508	0.26602
20	0.02940	-18.6090	-7.0310	0.2231	1.05384	-0.12829	0.30589	0.29966
30	0.02883	-41.3126	-16.1069	0.2221	1.06540	-0.12854	0.30603	0.30684
40	0.02863	-73.0846	-28.8203	0.2218	1.06961	-0.12864	0.30608	0.30944
50	0.02853	-113.931	-45.1682	0.2216	1.07158	-0.12868	0.30611	0.31065
60	0.02848	-163.852	-65.1496	0.2215	1.07267	-0.12870	0.30612	0.31132
70	0.02845	-222.849	-88.7645	0.2215	1.07332	-0.12872	0.30613	0.31172
80	0.02843	-290.923	-116.013	0.2214	1.07375	-0.12873	0.30613	0.31198
90	0.02842	-368.073	-146.894	0.2214	1.07404	-0.12873	0.30614	0.31216
100	0.02841	-454.299	-181.408	0.2214	1.07425	-0.12874	0.30614	0.31229

Table 4.8g: Numerical values of displacements and stresses for SSFS thick anisotropic rectangular plate for 90^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.07098	-2.6349	-0.6588	0.3309	1.46975	-0.06157	0.30617	0.28654
10	0.05738	-8.9967	-3.0501	0.2867	1.67697	-0.05974	0.27694	0.37501
20	0.05286	-33.6516	-12.8610	0.2700	1.75973	-0.05913	0.26522	0.40793
30	0.05194	-74.6242	-29.2495	0.2665	1.77713	-0.05900	0.26276	0.41475
40	0.05162	-131.968	-52.1990	0.2653	1.78339	-0.05896	0.26187	0.41720
50	0.05147	-205.692	-81.7069	0.2647	1.78632	-0.05894	0.26146	0.41834
60	0.05138	-295.796	-117.773	0.2644	1.78792	-0.05893	0.26123	0.41896
70	0.05133	-402.281	-160.396	0.2642	1.78889	-0.05892	0.26109	0.41934
80	0.05130	-525.149	-209.578	0.2641	1.78951	-0.05892	0.26100	0.41959
90	0.05128	-664.399	-265.316	0.2640	1.78995	-0.05891	0.26094	0.41975
100	0.05126	-820.031	-327.613	0.2639	1.79025	-0.05891	0.26090	0.41987

Table 4.9a: Numerical values of displacements and stresses for CCFC thick anisotropic rectangular plate for 0^0 @ α = 5 to 100, β = 1.5

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00037	-0.00365	-0.00929	-0.00064	-0.00005	0.00108	0.01566	0.00007
10	0.00012	-0.00836	-0.01263	-0.00036	-0.00002	0.00042	0.01619	0.00008
20	0.00006	-0.02693	-0.02506	-0.00029	-0.00001	0.00025	0.01633	0.00009
30	0.00005	-0.05786	-0.04569	-0.00028	-0.00001	0.00022	0.01636	0.00009
40	0.00005	-0.10116	-0.07456	-0.00027	-0.00001	0.00020	0.01636	0.00009
50	0.00004	-0.15682	-0.11167	-0.00027	-0.00001	0.00020	0.01637	0.00009
60	0.00004	-0.22486	-0.15703	-0.00027	-0.00001	0.00020	0.01637	0.00009
70	0.00004	-0.30526	-0.21063	-0.00027	-0.00001	0.00019	0.01637	0.00009
80	0.00004	-0.39803	-0.27248	-0.00027	-0.00001	0.00019	0.01637	0.00009
90	0.00004	-0.50318	-0.34258	-0.00027	-0.00001	0.00019	0.01637	0.00009
100	0.00004	-0.62069	-0.42092	-0.00027	-0.00001	0.00019	0.01637	0.00009

Table 4.9b: Numerical values of displacements and stresses for CCFC thick anisotropic rectangular plate for 15^0 @ α = 5 to 100, β = 1.5

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00061	-0.00569	-0.01633	-0.01473	-0.00128	0.00757	0.02656	-0.0004
10	0.00014	-0.00967	-0.01428	-0.00393	-0.00034	0.00198	0.01839	0.00021
20	0.00007	-0.03023	-0.02714	-0.00232	-0.00020	0.00115	0.01708	0.00037
30	0.00005	-0.06479	-0.05002	-0.00205	-0.00017	0.00101	0.01686	0.00040
40	0.00005	-0.11320	-0.08225	-0.00196	-0.00017	0.00097	0.01678	0.00041
50	0.00005	-0.17545	-0.12373	-0.00192	-0.00016	0.00094	0.01675	0.00041
60	0.00005	-0.25154	-0.17444	-0.00189	-0.00016	0.00093	0.01673	0.00041
70	0.00005	-0.34147	-0.23438	-0.00188	-0.00016	0.00093	0.01672	0.00042
80	0.00005	-0.44523	-0.30355	-0.00187	-0.00016	0.00092	0.01671	0.00042
90	0.00005	-0.56283	-0.38195	-0.00187	-0.00016	0.00092	0.01671	0.00042
100	0.00005	-0.69427	-0.46957	-0.00186	-0.00016	0.00092	0.01670	0.00042

Table 4.9c: Numerical values of displacements and stresses for CCFC thick anisotropic rectangular plate for 30^0 @ α = 5 to 100, β = 1.5

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	-0.0016	0.01213	0.04714	0.05488	0.01898	-0.05128	-0.0747	0.00350
10	0.00021	-0.01484	-0.02000	-0.00760	-0.00262	0.00703	0.02554	0.00075
20	0.00009	-0.04281	-0.03486	-0.00409	-0.00141	0.00376	0.01915	0.00131
30	0.00007	-0.09130	-0.06663	-0.00367	-0.00126	0.00337	0.01830	0.00142
40	0.00007	-0.15936	-0.11182	-0.00353	-0.00121	0.00324	0.01803	0.00146
50	0.00007	-0.24691	-0.17010	-0.00347	-0.00119	0.00319	0.01790	0.00148
60	0.00007	-0.35393	-0.24140	-0.00344	-0.00118	0.00316	0.01783	0.00149
70	0.00007	-0.48042	-0.32570	-0.00342	-0.00117	0.00314	0.01779	0.00149
80	0.00006	-0.62637	-0.42298	-0.00341	-0.00117	0.00313	0.01777	0.00150
90	0.00006	-0.79179	-0.53325	-0.00340	-0.00117	0.00312	0.01775	0.00150
100	0.00006	-0.97667	-0.65649	-0.00340	-0.00117	0.00311	0.01774	0.00150

Table 4.9d: Numerical values of displacements and stresses for CCFC thick anisotropic rectangular plate for 45^0 @ α = 5 to 100, β = 1.5

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	-0.0005	0.00300	0.01637	0.01418	0.01423	-0.02221	-0.0266	0.00152
10	0.00033	-0.02758	-0.02937	-0.00937	-0.00935	0.01455	0.03427	0.00255
20	0.00015	-0.07632	-0.05505	-0.00522	-0.00521	0.00809	0.02181	0.00331
30	0.00013	-0.16289	-0.11185	-0.00483	-0.00482	0.00748	0.02044	0.00350
40	0.00012	-0.28449	-0.19260	-0.00472	-0.00470	0.00730	0.02000	0.00357
50	0.00012	-0.44092	-0.29675	-0.00466	-0.00465	0.00722	0.01980	0.00360
60	0.00012	-0.63215	-0.42416	-0.00464	-0.00462	0.00718	0.01969	0.00362
70	0.00012	-0.85816	-0.57479	-0.00462	-0.00460	0.00715	0.01963	0.00363
80	0.00012	-1.11896	-0.74862	-0.00461	-0.00459	0.00714	0.01959	0.00364
90	0.00011	-1.41453	-0.94565	-0.00460	-0.00459	0.00713	0.01956	0.00364
100	0.00011	-1.74488	-1.16587	-0.00460	-0.00458	0.00712	0.01954	0.00364

Table 4.9e: Numerical values of displacements and stresses for CCFC thick anisotropic rectangular plate for 60^0 @ α = 5 to 100, β = 1.5

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	-0.0014	0.01332	0.03492	0.01529	0.04452	-0.04118	-0.0603	-0.0005
10	0.00049	-0.05283	-0.03966	-0.00656	-0.01893	0.01756	0.03259	0.00602
20	0.00029	-0.16528	-0.10959	-0.00482	-0.01388	0.01288	0.02340	0.00660
30	0.00027	-0.35782	-0.23712	-0.00463	-0.01335	0.01239	0.02223	0.00678
40	0.00026	-0.62780	-0.41681	-0.00458	-0.01319	0.01224	0.02185	0.00686
50	0.00026	-0.97501	-0.64815	-0.00455	-0.01312	0.01217	0.02167	0.00689
60	0.00026	-1.39941	-0.93102	-0.00454	-0.01308	0.01214	0.02158	0.00691
70	0.00025	-1.90100	-1.26537	-0.00453	-0.01306	0.01212	0.02153	0.00692
80	0.00025	-2.47977	-1.65118	-0.00453	-0.01305	0.01210	0.02149	0.00693
90	0.00025	-3.13570	-2.08845	-0.00452	-0.01304	0.01210	0.02146	0.00693
100	0.00025	-3.86882	-2.57718	-0.00452	-0.01303	0.01209	0.02145	0.00694

Table 4.9f: Numerical values of displacements and stresses for CCFC thick anisotropic rectangular plate for 75^0 @ α = 5 to 100, β = 1.5

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00158	-0.03604	-0.02709	-0.00336	-0.03805	0.01938	0.03719	0.00808
10	0.00073	-0.09730	-0.06111	-0.00208	-0.02333	0.01191	0.02237	0.00822
20	0.00061	-0.35905	-0.23366	-0.00195	-0.02192	0.01119	0.02024	0.00882
30	0.00059	-0.79587	-0.52448	-0.00193	-0.02173	0.01109	0.01988	0.00897
40	0.00058	-1.40748	-0.93207	-0.00193	-0.02168	0.01106	0.01976	0.00902
50	0.00057	-2.19384	-1.45624	-0.00192	-0.02165	0.01105	0.01970	0.00905
60	0.00057	-3.15495	-2.09694	-0.00192	-0.02164	0.01104	0.01967	0.00906
70	0.00057	-4.29081	-2.85416	-0.00192	-0.02163	0.01104	0.01965	0.00907
80	0.00057	-5.60142	-3.72789	-0.00192	-0.02162	0.01104	0.01964	0.00907
90	0.00057	-7.08678	-4.71812	-0.00192	-0.02162	0.01103	0.01963	0.00908
100	0.00057	-8.74689	-5.82485	-0.00192	-0.02162	0.01103	0.01963	0.00908

Table 4.9g: Numerical values of displacements and stresses for CCFC thick anisotropic rectangular plate for 90^0 @ α = 5 to 100, β = 1.5

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00119	-0.03494	-0.02001	-0.00026	-0.00234	0.00399	0.01629	0.00632
10	0.00091	-0.12931	-0.08069	-0.00024	-0.00236	0.00385	0.01553	0.00745
20	0.00084	-0.50550	-0.33059	-0.00024	-0.00241	0.00385	0.01531	0.00793
30	0.00083	-1.13227	-0.74825	-0.00024	-0.00242	0.00385	0.01527	0.00803
40	0.00082	-2.00971	-1.33314	-0.00024	-0.00243	0.00385	0.01525	0.00807
50	0.00082	-3.13783	-2.08519	-0.00024	-0.00243	0.00385	0.01524	0.00808
60	0.00082	-4.51664	-3.00438	-0.00024	-0.00243	0.00385	0.01524	0.00809
70	0.00082	-6.14615	-4.09071	-0.00024	-0.00243	0.00385	0.01524	0.00810
80	0.00082	-8.02635	-5.34416	-0.00024	-0.00243	0.00385	0.01524	0.00810
90	0.00082	-10.15724	-6.76475	-0.00024	-0.00244	0.00385	0.01524	0.00811
100	0.00082	-12.53882	-8.35247	-0.00024	-0.00244	0.00385	0.01523	0.00811

Table 4.10a: Numerical values of displacements and stresses for SCFS thick anisotropic rectangular plate for 0^0 @ α = 5 to 100, β = 1

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.01142	-0.04699	-0.17713	0.56898	0.02061	-0.01066	0.14369	0.00346
10	0.00464	-0.13268	-0.29131	0.40058	0.01014	-0.00518	0.14867	0.00336
20	0.00287	-0.47306	-0.72846	0.35664	0.00740	-0.00375	0.14997	0.00333
30	0.00253	-1.04010	-1.45500	0.34842	0.00689	-0.00348	0.15021	0.00332
40	0.00242	-1.83393	-2.47189	0.34554	0.00671	-0.00338	0.15030	0.00332
50	0.00236	-2.85455	-3.77925	0.34420	0.00662	-0.00334	0.15034	0.00332
60	0.00233	-4.10198	-5.37710	0.34348	0.00658	-0.00332	0.15036	0.00332
70	0.00232	-5.57622	-7.26545	0.34304	0.00655	-0.00330	0.15037	0.00332
80	0.00231	-7.27725	-9.44431	0.34275	0.00653	-0.00329	0.15038	0.00332
90	0.00230	-9.20509	-11.91369	0.34256	0.00652	-0.00329	0.15039	0.00332
100	0.00229	-11.35974	-14.67358	0.34242	0.00651	-0.00328	0.15039	0.00332

Table 4.10b: Numerical values of displacements and stresses for SCFS thick anisotropic rectangular plate for 15^0 @ $\alpha = 5$ to 100, $\beta = 1$

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.01241	-0.04764	-0.18425	0.47480	0.05264	-0.04346	0.16131	0.00872
10	0.00468	-0.13339	-0.26360	0.33722	0.03194	-0.01925	0.15064	0.02154
20	0.00289	-0.47869	-0.69672	0.30374	0.02744	-0.01451	0.14828	0.02583
30	0.00256	-1.05427	-1.43219	0.29754	0.02664	-0.01370	0.14786	0.02670
40	0.00245	-1.86010	-2.46373	0.29536	0.02636	-0.01342	0.14771	0.02700
50	0.00240	-2.89616	-3.79052	0.29436	0.02623	-0.01329	0.14764	0.02715
60	0.00237	-4.16246	-5.41236	0.29381	0.02616	-0.01322	0.14761	0.02723
70	0.00235	-5.65900	-7.32917	0.29348	0.02612	-0.01318	0.14758	0.02727
80	0.00234	-7.38577	-9.54093	0.29327	0.02609	-0.01315	0.14757	0.02730
90	0.00233	-9.34277	-12.04761	0.29312	0.02607	-0.01313	0.14756	0.02733
100	0.00233	-11.53002	-14.84922	0.29302	0.02606	-0.01312	0.14755	0.02734

Table 4.10c: Numerical values of displacements and stresses for SCFS thick anisotropic rectangular plate for 30^0 @ $\alpha = 5$ to 100, $\beta = 1$

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.01653	-0.05733	-0.26009	0.40131	0.14995	-0.14734	0.22385	0.00270
10	0.00532	-0.16116	-0.26786	0.27244	0.09234	-0.05238	0.15740	0.04378
20	0.00341	-0.58392	-0.77515	0.24577	0.08227	-0.04205	0.14732	0.05916
30	0.00308	-1.28738	-1.66921	0.24073	0.08049	-0.04072	0.14566	0.06251
40	0.00296	-2.27200	-2.92788	0.23896	0.07987	-0.04030	0.14510	0.06374
50	0.00291	-3.53786	-4.54813	0.23813	0.07959	-0.04011	0.14484	0.06431
60	0.00288	-5.08499	-6.52921	0.23768	0.07943	-0.04001	0.14470	0.06462
70	0.00286	-6.91341	-8.87084	0.23741	0.07934	-0.03995	0.14461	0.06482
80	0.00285	-9.02311	-11.57290	0.23723	0.07928	-0.03992	0.14456	0.06494
90	0.00284	-11.41411	-14.63535	0.23711	0.07924	-0.03989	0.14452	0.06502
100	0.00284	-14.08639	-18.05816	0.23703	0.07921	-0.03987	0.14449	0.06509

Table 4.10d: Numerical values of displacements and stresses for SCFS thick anisotropic rectangular plate for 45^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.02068	-0.07676	-0.31026	0.32529	0.31457	-0.23455	0.27262	0.01252
10	0.00689	-0.23935	-0.31411	0.20840	0.18629	-0.08908	0.15803	0.07645
20	0.00487	-0.87768	-1.07701	0.18975	0.16909	-0.07898	0.14448	0.10235
30	0.00451	-1.93557	-2.42032	0.18633	0.16619	-0.07813	0.14236	0.10831
40	0.00439	-3.41553	-4.31174	0.18513	0.16519	-0.07792	0.14164	0.11050
50	0.00433	-5.31803	-6.74663	0.18457	0.16473	-0.07783	0.14132	0.11154
60	0.00430	-7.64318	-9.72382	0.18427	0.16448	-0.07779	0.14114	0.11211
70	0.00428	-10.39103	-13.24286	0.18408	0.16433	-0.07777	0.14103	0.11246
80	0.00427	-13.56159	-17.30360	0.18397	0.16423	-0.07776	0.14097	0.11268
90	0.00426	-17.15487	-21.90593	0.18388	0.16416	-0.07775	0.14092	0.11284
100	0.00425	-21.17089	-27.04982	0.18383	0.16412	-0.07774	0.14088	0.11295

Table 4.10e: Numerical values of displacements and stresses for SCFS thick anisotropic rectangular plate for 60^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.02130	-0.13056	-0.22904	0.21081	0.45176	-0.17507	0.20344	0.06715
10	0.01091	-0.44764	-0.48552	0.15920	0.31816	-0.11695	0.14646	0.12776
20	0.00877	-1.66149	-1.98462	0.15100	0.30574	-0.11356	0.13755	0.15662
30	0.00836	-3.67260	-4.54835	0.14963	0.30449	-0.11354	0.13608	0.16325
40	0.00822	-6.48616	-8.14774	0.14916	0.30415	-0.11359	0.13558	0.16569
50	0.00815	-10.10301	-12.77844	0.14894	0.30400	-0.11362	0.13535	0.16684
60	0.00812	-14.52337	-18.43932	0.14883	0.30393	-0.11364	0.13522	0.16747
70	0.00810	-19.74733	-25.12998	0.14876	0.30389	-0.11365	0.13515	0.16786
80	0.00808	-25.77492	-32.85025	0.14871	0.30386	-0.11366	0.13510	0.16811
90	0.00807	-32.60615	-41.60005	0.14868	0.30384	-0.11367	0.13507	0.16828
100	0.00807	-40.24103	-51.37935	0.14866	0.30383	-0.11367	0.13504	0.16840

Table 4.10f: Numerical values of displacements and stresses for SCFS thick anisotropic rectangular plate for 75^0 @ α = 5 to 100, β = 1

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.03041	-0.28728	-0.26017	0.18369	0.57951	-0.11131	0.13936	0.13608
10	0.02200	-1.01620	-1.08653	0.16771	0.58015	-0.10580	0.12584	0.19354
20	0.01964	-3.84614	-4.66539	0.16308	0.60523	-0.10623	0.12204	0.21921
30	0.01917	-8.54722	-10.67695	0.16216	0.61176	-0.10644	0.12130	0.22486
40	0.01901	-15.12630	-19.10043	0.16183	0.61421	-0.10653	0.12104	0.22691
50	0.01893	-23.58442	-29.93271	0.16168	0.61537	-0.10657	0.12091	0.22788
60	0.01889	-33.92185	-43.17297	0.16159	0.61601	-0.10660	0.12085	0.22841
70	0.01886	-46.13868	-58.82093	0.16154	0.61640	-0.10661	0.12080	0.22873
80	0.01885	-60.23495	-76.87646	0.16151	0.61665	-0.10662	0.12078	0.22894
90	0.01884	-76.21070	-97.33952	0.16149	0.61683	-0.10663	0.12076	0.22908
100	0.01883	-94.06591	-120.2101	0.16147	0.61695	-0.10663	0.12075	0.22918

Table 4.10g: Numerical values of displacements and stresses for SCFS thick anisotropic rectangular plate for 90^0 @ α = 5 to 100, β = 1

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.04413	-0.47591	-0.41091	0.23768	0.92449	-0.04583	0.11354	0.17738
10	0.03577	-1.71745	-1.89696	0.21662	1.05256	-0.04600	0.10640	0.23627
20	0.03323	-6.57775	-8.07927	0.20848	1.11518	-0.04633	0.10332	0.26064
30	0.03273	-14.66049	-18.42314	0.20676	1.12907	-0.04641	0.10265	0.26587
40	0.03255	-25.97359	-32.91072	0.20614	1.13413	-0.04644	0.10241	0.26777
50	0.03247	-40.51823	-51.53936	0.20585	1.13650	-0.04646	0.10230	0.26865
60	0.03242	-58.29472	-74.30837	0.20569	1.13780	-0.04646	0.10223	0.26914
70	0.03240	-79.30315	-101.2175	0.20560	1.13859	-0.04647	0.10220	0.26943
80	0.03238	-103.5436	-132.2667	0.20554	1.13910	-0.04647	0.10217	0.26962
90	0.03237	-131.0160	-167.4559	0.20549	1.13946	-0.04648	0.10216	0.26976
100	0.03236	-161.7205	-206.7850	0.20546	1.13971	-0.04648	0.10214	0.26985

Table 4.11a: Numerical values of displacements and stresses for CSFS thick anisotropic rectangular plate for 0^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00223	-0.03967	-0.04963	0.12045	0.00568	-0.00192	0.07408	0.00199
10	0.00117	-0.13489	-0.10811	0.10203	0.00346	-0.00124	0.07809	0.00182
20	0.00089	-0.51419	-0.33411	0.09712	0.00286	-0.00105	0.07917	0.00177
30	0.00083	-1.14618	-0.70994	0.09620	0.00274	-0.00101	0.07937	0.00176
40	0.00081	-2.03094	-1.23597	0.09588	0.00270	-0.00100	0.07944	0.00176
50	0.00081	-3.16848	-1.91228	0.09573	0.00268	-0.00100	0.07947	0.00176
60	0.00080	-4.55882	-2.73885	0.09564	0.00267	-0.00099	0.07949	0.00175
70	0.00080	-6.20193	-3.71571	0.09559	0.00267	-0.00099	0.07950	0.00175
80	0.00080	-8.09784	-4.84285	0.09556	0.00266	-0.00099	0.07951	0.00175
90	0.00079	-10.2465	-6.12028	0.09554	0.00266	-0.00099	0.07951	0.00175
100	0.00079	-12.6480	-7.54799	0.09552	0.00266	-0.00099	0.07952	0.00175

Table 4.11b: Numerical values of displacements and stresses for CSFS thick anisotropic rectangular plate for 15^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00190	-0.03372	-0.04062	0.09526	0.01116	-0.00629	0.06354	0.00277
10	0.00108	-0.12604	-0.09445	0.08677	0.00895	-0.00439	0.07018	0.00498
20	0.00085	-0.49274	-0.31187	0.08425	0.00838	-0.00392	0.07211	0.00579
30	0.00080	-1.10357	-0.67488	0.08376	0.00827	-0.00383	0.07248	0.00596
40	0.00078	-1.95868	-1.18321	0.08359	0.00823	-0.00380	0.07261	0.00602
50	0.00078	-3.05810	-1.83680	0.08351	0.00822	-0.00379	0.07267	0.00605
60	0.00077	-4.40183	-2.63565	0.08347	0.00821	-0.00378	0.07271	0.00606
70	0.00077	-5.98987	-3.57975	0.08344	0.00820	-0.00377	0.07273	0.00607
80	0.00077	-7.82222	-4.66910	0.08342	0.00820	-0.00377	0.07274	0.00608
90	0.00077	-9.89888	-5.90370	0.08341	0.00820	-0.00377	0.07275	0.00608
100	0.00077	-12.21985	-7.28355	0.08340	0.00819	-0.00377	0.07276	0.00609

Table 4.11c: Numerical values of displacements and stresses for CSFS thick anisotropic rectangular plate for 30^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00148	-0.02718	-0.02880	0.05985	0.02199	-0.01161	0.04805	0.00384
10	0.00097	-0.11866	-0.07498	0.05998	0.02102	-0.00940	0.05529	0.01048
20	0.00080	-0.47596	-0.28317	0.05968	0.02082	-0.00914	0.05817	0.01371
30	0.00077	-1.06967	-0.63517	0.05960	0.02079	-0.00912	0.05880	0.01444
40	0.00076	-1.90057	-1.12879	0.05957	0.02078	-0.00911	0.05902	0.01471
50	0.00075	-2.96879	-1.76369	0.05955	0.02077	-0.00911	0.05913	0.01484
60	0.00075	-4.27435	-2.53977	0.05954	0.02077	-0.00911	0.05919	0.01491
70	0.00075	-5.81727	-3.45700	0.05954	0.02077	-0.00911	0.05922	0.01495
80	0.00075	-7.59756	-4.51536	0.05953	0.02077	-0.00911	0.05924	0.01498
90	0.00074	-9.61521	-5.71485	0.05953	0.02076	-0.00911	0.05926	0.01499
100	0.00074	-11.87023	-7.05547	0.05953	0.02076	-0.00911	0.05927	0.01501

Table 4.11d: Numerical values of displacements and stresses for CSFS thick anisotropic rectangular plate for 45^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00138	-0.03067	-0.02145	0.03818	0.03643	-0.01332	0.03658	0.00677
10	0.00103	-0.13616	-0.07020	0.03890	0.03640	-0.01268	0.04245	0.01655
20	0.00089	-0.53692	-0.30116	0.03919	0.03686	-0.01301	0.04585	0.02173
30	0.00086	-1.20032	-0.69383	0.03926	0.03700	-0.01312	0.04668	0.02296
40	0.00084	-2.12832	-1.24490	0.03928	0.03705	-0.01316	0.04698	0.02342
50	0.00084	-3.32122	-1.95379	0.03929	0.03707	-0.01318	0.04713	0.02364
60	0.00084	-4.77913	-2.82037	0.03930	0.03708	-0.01320	0.04721	0.02376
70	0.00083	-6.50208	-3.84458	0.03930	0.03709	-0.01320	0.04726	0.02383
80	0.00083	-8.49007	-5.02640	0.03931	0.03710	-0.01321	0.04729	0.02388
90	0.00083	-10.74311	-6.36581	0.03931	0.03710	-0.01321	0.04731	0.02391
100	0.00083	-13.26121	-7.86282	0.03931	0.03710	-0.01321	0.04732	0.02393

Table 4.11e: Numerical values of displacements and stresses for CSFS thick anisotropic rectangular plate for 60^0 @ $\alpha = 5$ to 100, $\beta = 1$

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00180	-0.05349	-0.02012	0.02516	0.05654	-0.01341	0.02787	0.01363
10	0.00143	-0.20607	-0.09395	0.02597	0.05988	-0.01398	0.03391	0.02520
20	0.00126	-0.78039	-0.42689	0.02646	0.06256	-0.01438	0.03706	0.03105
30	0.00122	-1.73017	-0.98957	0.02657	0.06322	-0.01448	0.03780	0.03241
40	0.00120	-3.05862	-1.77862	0.02662	0.06347	-0.01452	0.03807	0.03291
50	0.00120	-4.76627	-2.79350	0.02664	0.06359	-0.01453	0.03820	0.03315
60	0.00119	-6.85326	-4.03404	0.02665	0.06365	-0.01454	0.03827	0.03328
70	0.00119	-9.31963	-5.50022	0.02666	0.06369	-0.01455	0.03831	0.03336
80	0.00119	-12.16540	-7.19199	0.02666	0.06372	-0.01455	0.03834	0.03341
90	0.00119	-15.39060	-9.10936	0.02666	0.06374	-0.01456	0.03836	0.03345
100	0.00119	-18.99521	-11.2523	0.02667	0.06375	-0.01456	0.03838	0.03347

Table 4.11f: Numerical values of displacements and stresses for CSFS thick anisotropic rectangular plate for 75^0 @ $\alpha = 5$ to 100, $\beta = 1$

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00357	-0.12522	-0.03856	0.02315	0.10238	-0.01171	0.02643	0.02782
10	0.00276	-0.42170	-0.19237	0.02192	0.11720	-0.01148	0.02870	0.04183
20	0.00243	-1.53275	-0.84324	0.02132	0.12436	-0.01136	0.02947	0.04781
30	0.00235	-3.37142	-1.93426	0.02119	0.12595	-0.01133	0.02963	0.04910
40	0.00233	-5.94352	-3.46264	0.02114	0.12653	-0.01132	0.02969	0.04957
50	0.00232	-9.24993	-5.42798	0.02111	0.12680	-0.01132	0.02972	0.04979
60	0.00231	-13.29087	-7.83018	0.02110	0.12695	-0.01132	0.02973	0.04991
70	0.00231	-18.06642	-10.6692	0.02109	0.12704	-0.01132	0.02974	0.04999
80	0.00230	-23.57662	-13.9450	0.02109	0.12710	-0.01132	0.02975	0.05004
90	0.00230	-29.82148	-17.6576	0.02108	0.12714	-0.01131	0.02975	0.05007
100	0.00230	-36.80101	-21.8070	0.02108	0.12717	-0.01131	0.02975	0.05009

Table 4.11g: Numerical values of displacements and stresses for CSFS thick anisotropic rectangular plate for 90^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00671	-0.24917	-0.07936	0.03177	0.18700	-0.00597	0.02907	0.04818
0	0.00481	-0.75286	-0.35162	0.02463	0.20451	-0.00525	0.02438	0.06337
20	0.00415	-2.63817	-1.46232	0.02190	0.21170	-0.00497	0.02247	0.06901
30	0.00401	-5.76093	-3.31674	0.02134	0.21322	-0.00492	0.02206	0.07017
40	0.00396	-10.12992	-5.91340	0.02113	0.21377	-0.00490	0.02192	0.07059
50	0.00394	-15.74639	-9.25211	0.02104	0.21402	-0.00489	0.02185	0.07078
60	0.00393	-22.61065	-13.3328	0.02098	0.21416	-0.00488	0.02181	0.07089
70	0.00392	-30.72281	-18.1555	0.02095	0.21425	-0.00488	0.02179	0.07095
80	0.00392	-40.08293	-23.7201	0.02093	0.21430	-0.00488	0.02178	0.07100
90	0.00391	-50.69101	-30.0267	0.02092	0.21434	-0.00488	0.02177	0.07103
100	0.00391	-62.54707	-37.0752	0.02091	0.21437	-0.00487	0.02176	0.07105

Table 4.12a: Numerical values of displacements and stresses for CCFS thick anisotropic rectangular plate for 0^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00159	-0.00652	-0.03598	0.07930	0.00404	-0.00159	0.01999	0.00107
10	0.00066	-0.01882	-0.06116	0.05696	0.00195	-0.00080	0.02114	0.00088
20	0.00041	-0.06750	-0.15426	0.05097	0.00138	-0.00058	0.02145	0.00081
30	0.00036	-0.14858	-0.30860	0.04984	0.00127	-0.00054	0.02151	0.00080
40	0.00035	-0.26207	-0.52455	0.04945	0.00123	-0.00052	0.02153	0.00080
50	0.00034	-0.40799	-0.80217	0.04926	0.00122	-0.00052	0.02154	0.00080
60	0.00033	-0.58634	-1.14147	0.04916	0.00121	-0.00051	0.02154	0.00079
70	0.00033	-0.79711	-1.54246	0.04910	0.00120	-0.00051	0.02154	0.00079
80	0.00033	-1.04031	-2.00513	0.04906	0.00120	-0.00051	0.02155	0.00079
90	0.00033	-1.31594	-2.52949	0.04904	0.00120	-0.00051	0.02155	0.00079
100	0.00033	-1.62399	-3.11555	0.04902	0.00119	-0.00051	0.02155	0.00079

Table 4.12b: Numerical values of displacements and stresses for CCFS thick anisotropic rectangular plate for 15^0 @ $\alpha = 5$ to 100, $\beta = 1$

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00151	-0.00553	-0.03283	0.05377	0.00716	-0.00561	0.01993	0.00178
10	0.00061	-0.01706	-0.05089	0.04234	0.00446	-0.00270	0.02028	0.00437
20	0.00038	-0.06257	-0.13608	0.03903	0.00382	-0.00206	0.02039	0.00529
30	0.00034	-0.13833	-0.27992	0.03839	0.00370	-0.00195	0.02042	0.00548
40	0.00032	-0.24437	-0.48157	0.03816	0.00366	-0.00192	0.02043	0.00554
50	0.00032	-0.38071	-0.74090	0.03806	0.00365	-0.00190	0.02043	0.00558
60	0.00031	-0.54735	-1.05790	0.03800	0.00363	-0.00189	0.02043	0.00559
70	0.00031	-0.74429	-1.43254	0.03797	0.00363	-0.00188	0.02043	0.00560
80	0.00031	-0.97152	-1.86483	0.03794	0.00362	-0.00188	0.02043	0.00561
90	0.00031	-1.22905	-2.35476	0.03793	0.00362	-0.00188	0.02043	0.00561
100	0.00031	-1.51688	-2.90233	0.03792	0.00362	-0.00187	0.02043	0.00562

Table 4.12c: Numerical values of displacements and stresses for CCFS thick anisotropic rectangular plate for 30^0 @ $\alpha = 5$ to 100, $\beta = 1$

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00150	-0.00466	-0.03536	0.03388	0.01403	-0.01428	0.02122	0.00025
10	0.00061	-0.01791	-0.04554	0.03006	0.01059	-0.00643	0.01909	0.00764
20	0.00040	-0.06795	-0.13527	0.02825	0.00974	-0.00534	0.01886	0.01075
30	0.00036	-0.15082	-0.29176	0.02784	0.00958	-0.00519	0.01883	0.01144
40	0.00035	-0.26676	-0.51190	0.02770	0.00952	-0.00514	0.01883	0.01169
50	0.00034	-0.41580	-0.79524	0.02763	0.00950	-0.00512	0.01882	0.01180
60	0.00034	-0.59795	-1.14166	0.02759	0.00948	-0.00511	0.01882	0.01187
70	0.00034	-0.81322	-1.55112	0.02756	0.00947	-0.00510	0.01882	0.01191
80	0.00034	-1.06160	-2.02361	0.02755	0.00947	-0.00510	0.01882	0.01193
90	0.00033	-1.34309	-2.55910	0.02754	0.00946	-0.00510	0.01882	0.01195
100	0.00033	-1.65771	-3.15761	0.02753	0.00946	-0.00509	0.01882	0.01196

Table 4.12d: Numerical values of displacements and stresses for CCFS thick anisotropic rectangular plate for 45^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00151	-0.00495	-0.03319	0.02511	0.02573	-0.01787	0.02089	0.00163
10	0.00070	-0.02365	-0.04686	0.02124	0.01946	-0.00963	0.01730	0.01205
20	0.00051	-0.09095	-0.16656	0.02015	0.01836	-0.00890	0.01703	0.01685
30	0.00047	-0.20181	-0.37559	0.01992	0.01817	-0.00885	0.01703	0.01797
40	0.00046	-0.35680	-0.66976	0.01984	0.01811	-0.00884	0.01703	0.01838
50	0.00045	-0.55601	-1.04841	0.01980	0.01808	-0.00884	0.01703	0.01857
60	0.00045	-0.79946	-1.51138	0.01978	0.01807	-0.00883	0.01703	0.01868
70	0.00045	-1.08716	-2.05860	0.01977	0.01806	-0.00883	0.01703	0.01875
80	0.00045	-1.41911	-2.69006	0.01976	0.01805	-0.00883	0.01703	0.01879
90	0.00045	-1.79533	-3.40574	0.01976	0.01805	-0.00883	0.01703	0.01882
100	0.00045	-2.21580	-4.20563	0.01975	0.01804	-0.00883	0.01703	0.01884

Table 4.12e: Numerical values of displacements and stresses for CCFS thick anisotropic rectangular plate for 60^0 @ α = 5 to 100, β = 1

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00167	-0.01010	-0.02435	0.01823	0.04126	-0.01406	0.01618	0.00923
10	0.00103	-0.04147	-0.06535	0.01599	0.03361	-0.01164	0.01501	0.01955
20	0.00083	-0.15678	-0.27610	0.01568	0.03360	-0.01159	0.01500	0.02472
30	0.00079	-0.34698	-0.63596	0.01564	0.03375	-0.01162	0.01503	0.02592
40	0.00078	-0.61293	-1.14118	0.01563	0.03382	-0.01164	0.01504	0.02637
50	0.00077	-0.95477	-1.79117	0.01562	0.03385	-0.01165	0.01504	0.02658
60	0.00077	-1.37253	-2.58575	0.01562	0.03387	-0.01165	0.01504	0.02669
70	0.00077	-1.86624	-3.52488	0.01562	0.03388	-0.01165	0.01505	0.02676
80	0.00076	-2.43589	-4.60854	0.01562	0.03389	-0.01166	0.01505	0.02681
90	0.00076	-3.08149	-5.83670	0.01562	0.03389	-0.01166	0.01505	0.02684
100	0.00076	-3.80304	-7.20937	0.01562	0.03390	-0.01166	0.01505	0.02686

Table 4.12f: Numerical values of displacements and stresses for CCFS thick anisotropic rectangular plate for 75^0 @ $\alpha = 5$ to 100, $\beta = 1$

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00283	-0.02673	-0.03154	0.01805	0.06637	-0.01067	0.01296	0.02145
10	0.00206	-0.09435	-0.14119	0.01695	0.07170	-0.01038	0.01261	0.03258
20	0.00179	-0.34902	-0.61686	0.01649	0.07672	-0.01037	0.01241	0.03772
30	0.00173	-0.77048	-1.41669	0.01639	0.07796	-0.01037	0.01237	0.03887
40	0.00171	-1.36004	-2.53757	0.01635	0.07843	-0.01037	0.01235	0.03929
50	0.00170	-2.11791	-3.97903	0.01633	0.07865	-0.01037	0.01234	0.03949
60	0.00170	-3.04414	-5.74094	0.01632	0.07877	-0.01037	0.01234	0.03960
70	0.00169	-4.13875	-7.82326	0.01632	0.07884	-0.01037	0.01234	0.03966
80	0.00169	-5.40175	-10.2259	0.01631	0.07889	-0.01037	0.01233	0.03970
90	0.00169	-6.83314	-12.9491	0.01631	0.07892	-0.01037	0.01233	0.03973
100	0.00169	-8.43293	-15.9925	0.01631	0.07894	-0.01037	0.01233	0.03975

Table 4.12g: Numerical values of displacements and stresses for CCFS thick anisotropic rectangular plate for 90^0 @ $\alpha = 5$ to 100, $\beta = 1$

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00472	-0.05087	-0.05596	0.02575	0.13271	-0.00501	0.01212	0.03372
10	0.00350	-0.16793	-0.25559	0.02165	0.14959	-0.00472	0.01067	0.04645
20	0.00308	-0.61020	-1.08704	0.01989	0.15827	-0.00461	0.00997	0.05188
30	0.00300	-1.34278	-2.47858	0.01951	0.16023	-0.00459	0.00982	0.05306
40	0.00297	-2.36770	-4.42763	0.01937	0.16094	-0.00458	0.00976	0.05349
50	0.00295	-3.68524	-6.93381	0.01930	0.16128	-0.00458	0.00973	0.05369
60	0.00295	-5.29550	-9.99702	0.01927	0.16147	-0.00457	0.00972	0.05380
70	0.00294	-7.19849	-13.6172	0.01924	0.16158	-0.00457	0.00971	0.05387
80	0.00294	-9.39423	-17.7944	0.01923	0.16165	-0.00457	0.00970	0.05391
90	0.00294	-11.8827	-22.5286	0.01922	0.16170	-0.00457	0.00970	0.05394
100	0.00293	-14.6639	-27.8197	0.01921	0.16174	-0.00457	0.00970	0.05396

Table 4.13a: Numerical values of displacements and stresses for SCFC thick anisotropic rectangular plate for 0^0 @ α = 5 to 100, β = 1.5

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00020	-0.00257	-0.00509	-0.00045	-0.00003	0.00063	0.00786	0.00007
10	0.00008	-0.00722	-0.00827	-0.00031	-0.00001	0.00030	0.00808	0.00008
20	0.00005	-0.02569	-0.02060	-0.00028	-0.00001	0.00022	0.00814	0.00009
30	0.00004	-0.05646	-0.04112	-0.00027	-0.00001	0.00020	0.00815	0.00009
40	0.00004	-0.09955	-0.06984	-0.00027	-0.00001	0.00020	0.00815	0.00009
50	0.00004	-0.15494	-0.10677	-0.00027	-0.00001	0.00019	0.00815	0.00009
60	0.00004	-0.22264	-0.15191	-0.00027	-0.00001	0.00019	0.00816	0.00009
70	0.00004	-0.30266	-0.20525	-0.00027	-0.00001	0.00019	0.00816	0.00009
80	0.00004	-0.39498	-0.26680	-0.00027	-0.00001	0.00019	0.00816	0.00009
90	0.00004	-0.49961	-0.33655	-0.00027	-0.00001	0.00019	0.00816	0.00009
100	0.00004	-0.61655	-0.41451	-0.00026	-0.00001	0.00019	0.00816	0.00009

Table 4.13b: Numerical values of displacements and stresses for SCFC thick anisotropic rectangular plate for 15^0 @ α = 5 to 100, β = 1.5

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00023	-0.00267	-0.00526	-0.00525	-0.00045	0.00267	0.00912	0.00034
10	0.00008	-0.00727	-0.00721	-0.00235	-0.00020	0.00117	0.00827	0.00079
20	0.00005	-0.02591	-0.01931	-0.00181	-0.00015	0.00090	0.00809	0.00093
30	0.00005	-0.05699	-0.03997	-0.00173	-0.00015	0.00085	0.00806	0.00096
40	0.00004	-0.10049	-0.06895	-0.00169	-0.00014	0.00083	0.00804	0.00097
50	0.00004	-0.15643	-0.10623	-0.00168	-0.00014	0.00083	0.00804	0.00098
60	0.00004	-0.22480	-0.15180	-0.00167	-0.00014	0.00082	0.00804	0.00098
70	0.00004	-0.30560	-0.20567	-0.00167	-0.00014	0.00082	0.00804	0.00098
80	0.00004	-0.39883	-0.26782	-0.00167	-0.00014	0.00082	0.00803	0.00098
90	0.00004	-0.50449	-0.33826	-0.00166	-0.00014	0.00082	0.00803	0.00098
100	0.00004	-0.62258	-0.41698	-0.00166	-0.00014	0.00082	0.00803	0.00098

Table 4.13c: Numerical values of displacements and stresses for SCFC thick anisotropic rectangular plate for 30^0 @ α = 5 to 100, β = 1.5

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00034	-0.00361	-0.00858	-0.01101	-0.00380	0.01025	0.01429	0.00011
10	0.00010	-0.00908	-0.00745	-0.00349	-0.00120	0.00320	0.00893	0.00154
20	0.00006	-0.03225	-0.02176	-0.00281	-0.00096	0.00257	0.00821	0.00203
30	0.00006	-0.07084	-0.04726	-0.00273	-0.00094	0.00250	0.00809	0.00214
40	0.00005	-0.12486	-0.08319	-0.00270	-0.00093	0.00248	0.00805	0.00218
50	0.00005	-0.19431	-0.12945	-0.00269	-0.00092	0.00247	0.00803	0.00219
60	0.00005	-0.27919	-0.18602	-0.00269	-0.00092	0.00246	0.00802	0.00220
70	0.00005	-0.37950	-0.25288	-0.00268	-0.00092	0.00246	0.00802	0.00221
80	0.00005	-0.49525	-0.33004	-0.00268	-0.00092	0.00246	0.00801	0.00221
90	0.00005	-0.62643	-0.41748	-0.00268	-0.00092	0.00245	0.00801	0.00222
100	0.00005	-0.77304	-0.51522	-0.00268	-0.00092	0.00245	0.00801	0.00222

Table 4.13d: Numerical values of displacements and stresses for SCFC thick anisotropic rectangular plate for 45^0 @ α = 5 to 100, β = 1.5

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00049	-0.00553	-0.01204	-0.01223	-0.01225	0.01909	0.02007	0.00034
10	0.00013	-0.01407	-0.00922	-0.00367	-0.00366	0.00569	0.00935	0.00259
20	0.00009	-0.05032	-0.03160	-0.00322	-0.00321	0.00498	0.00832	0.00339
30	0.00008	-0.11052	-0.07135	-0.00318	-0.00317	0.00493	0.00816	0.00357
40	0.00008	-0.19474	-0.12737	-0.00317	-0.00316	0.00491	0.00811	0.00364
50	0.00008	-0.30301	-0.19949	-0.00317	-0.00316	0.00491	0.00808	0.00367
60	0.00008	-0.43534	-0.28767	-0.00317	-0.00316	0.00491	0.00807	0.00369
70	0.00008	-0.59173	-0.39191	-0.00317	-0.00316	0.00491	0.00806	0.00370
80	0.00008	-0.77217	-0.51219	-0.00317	-0.00316	0.00490	0.00806	0.00370
90	0.00008	-0.97667	-0.64852	-0.00317	-0.00316	0.00490	0.00805	0.00371
100	0.00008	-1.20523	-0.80088	-0.00317	-0.00316	0.00490	0.00805	0.00371

Table 4.13e: Numerical values of displacements and stresses for SCFC thick anisotropic rectangular plate for 60^0 @ $\alpha = 5$ to 100, $\beta = 1.5$

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00048	-0.00892	-0.00853	-0.00507	-0.01466	0.01359	0.01429	0.00226
10	0.00022	-0.02738	-0.01535	-0.00295	-0.00848	0.00788	0.00899	0.00414
20	0.00017	-0.10028	-0.06221	-0.00283	-0.00815	0.00756	0.00826	0.00499
30	0.00016	-0.22128	-0.14250	-0.00282	-0.00814	0.00755	0.00814	0.00518
40	0.00016	-0.39059	-0.25524	-0.00282	-0.00814	0.00756	0.00810	0.00525
50	0.00016	-0.60825	-0.40029	-0.00283	-0.00814	0.00756	0.00808	0.00528
60	0.00016	-0.87428	-0.57760	-0.00283	-0.00815	0.00756	0.00807	0.00530
70	0.00016	-1.18867	-0.78718	-0.00283	-0.00815	0.00756	0.00806	0.00531
80	0.00016	-1.55142	-1.02900	-0.00283	-0.00815	0.00756	0.00806	0.00532
90	0.00016	-1.96254	-1.30307	-0.00283	-0.00815	0.00756	0.00805	0.00532
100	0.00016	-2.42202	-1.60938	-0.00283	-0.00815	0.00756	0.00805	0.00533

Table 4.13f: Numerical values of displacements and stresses for SCFC thick anisotropic rectangular plate for 75^0 @ $\alpha = 5$ to 100, $\beta = 1.5$

α	$\overline{w}$	$\overline{u}$	$\overline{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00063	-0.01819	-0.00923	-0.00141	-0.01572	0.00805	0.00898	0.00413
10	0.00045	-0.06399	-0.03674	-0.00131	-0.01467	0.00750	0.00788	0.00565
20	0.00041	-0.24407	-0.15560	-0.00131	-0.01474	0.00753	0.00762	0.00630
30	0.00040	-0.54364	-0.35506	-0.00131	-0.01478	0.00754	0.00757	0.00643
40	0.00039	-0.96295	-0.63451	-0.00131	-0.01479	0.00755	0.00755	0.00648
50	0.00039	-1.50204	-0.99386	-0.00131	-0.01480	0.00755	0.00754	0.00651
60	0.00039	-2.16091	-1.43309	-0.00131	-0.01480	0.00755	0.00754	0.00652
70	0.00039	-2.93958	-1.95219	-0.00131	-0.01480	0.00756	0.00753	0.00653
80	0.00039	-3.83804	-2.55115	-0.00132	-0.01481	0.00756	0.00753	0.00653
90	0.00039	-4.85629	-3.22998	-0.00132	-0.01481	0.00756	0.00753	0.00654
100	0.00039	-5.99434	-3.98867	-0.00132	-0.01481	0.00756	0.00753	0.00654

Table 4.13g: Numerical values of displacements and stresses for SCFC thick anisotropic rectangular plate for 90^0 @ α = 5 to 100, β = 1.5

α	$\bar{w}$	$\bar{u}$	$\bar{v}$	$\overline{\sigma_{xx}}$	$\overline{\sigma_{yy}}$	$\overline{\tau_{xy}}$	$\overline{\tau_{xz}}$	$\overline{\tau_{yz}}$
5	0.00087	-0.02882	-0.01440	-0.00021	-0.00169	0.00310	0.00688	0.00472
10	0.00073	-0.10771	-0.06476	-0.00020	-0.00189	0.00315	0.00662	0.00599
20	0.00069	-0.42030	-0.27229	-0.00020	-0.00199	0.00318	0.00652	0.00648
30	0.00068	-0.94083	-0.61913	-0.00020	-0.00201	0.00319	0.00650	0.00659
40	0.00068	-1.66950	-1.10485	-0.00020	-0.00201	0.00319	0.00649	0.00662
50	0.00068	-2.60635	-1.72938	-0.00020	-0.00202	0.00320	0.00649	0.00664
60	0.00068	-3.75137	-2.49272	-0.00020	-0.00202	0.00320	0.00649	0.00665
70	0.00068	-5.10458	-3.39485	-0.00020	-0.00202	0.00320	0.00649	0.00666
80	0.00068	-6.66597	-4.43577	-0.00020	-0.00202	0.00320	0.00649	0.00666
90	0.00068	-8.43555	-5.61548	-0.00020	-0.00202	0.00320	0.00649	0.00666
100	0.00068	-10.41331	-6.93399	-0.00020	-0.00202	0.00320	0.00649	0.00666

4.2 Discussions of results

The results obtained from the solution were discussed in details in the following sections.

4.2.1 Total Potential Energy Functional

The total potential energy functional for the thick anisotropic rectangular plate derived in this work can be used to analyze rectangular thick anisotropic plate of any boundary condition and it was used here to solve for rectangular plate subjected under pure bending loading. Although, it can also solve buckling loading and vibration loading when the external work is substituted appropriately. It is presented here in the expanded form to accommodate the exact displacement functions unlike that of other works like Shimpi and Patel (2005), Reddy (1984), Atashipour *et al.* (2017) that assumed their displacement functions and had no need for such expansion. Hence it is similar when compare with other works in a minimized form but exhibit some level of differences when compared in the expanded form. The above statements can be relied on to confirm the efficiency of this Equation (4.1) for the analysis of thick anisotropic rectangular plate. The equation is a combination of differential of central deflection (w), in-plane rotational displacement (ϕ_x) on x-axis and in-plane rotational displacement (ϕ_y) on y-axis. Previous work on thick anisotropic rectangular plate did not care to separate the two rotational in-plane displacements (ϕ_x, ϕ_y) because they assumed their displacement functions and has no need for further expansion.

4.2.2 Governing equation and compatibility equations

The total potential energy were minimized with displacements to obtain the governing equation of equilibrium and the two compatibility equations of thick anisotropic plate. The governing equation obtained in Equation (4.2) is similar to those obtained by Shimpi and Patel (2006), Reddy (2014), etc but their various works were able to obtained one compatibility equation in addition to their governing equation unlike the present work that obtained two compatibility Equations (4.3 and 4.4). The governing equation comprises the external work (pure bending loading), differentials of out-plane displacement (W), differential of in-plane rotational displacement in x-axis and differential of in-plane rotational displacement in y-axis. The compatibility equations contain the differentials of out-plane displacement (W), differential of in-plane rotational displacement in x-axis, differential of in-plane rotational displacement in y-axis, whole in-plane rotational displacement in x-axis and whole in-plane rotational displacement in y-axis.

4.2.3 Exact polynomial displacement functions and polynomial stiffness coefficients

The exact polynomial displacement functions and polynomial stiffness coefficients are discussed in sections 4.2.3.1 and 4.2.3.2.

4.2.3.1 Exact polynomial displacement functions

The exact polynomial displacement functions for the twelve plate boundary conditions were obtained and tabulated in Table 4.1a. The results are discussed based on each particular boundary condition and geometric parameters of the plate as follows:

SSSS plate: The displacement function (ϕ_x) yielded meaningful value ($0.3125A_2$) when considering edge – middle points (i.e. x = 0, y = b/2) along the x and y directions of the thick orthotropic rectangular plates. The in-plane displacement function (ϕ_y) gave $0.3125A_3$ at points x = a/2 and y = 0 along both x and y directions of the rectangular thick anisotropic plate. The deflection (w) and the differential of the displacement functions (ϕ_x^{I}, ϕ_y^{I}) yielded meaningful values ($0.097656A_1$, -$0.9375A_2$ and -$0.9375A_3$) at the middle points (i.e. x = a/2, y = b/2) along both x and y directions of the rectangular plate. Also the second differential of the out-plane displacement (W_{xy}^{II}) along x and y directions yielded $1A_1$ at edge points (i.e. x = 0, y = 0 and x = a, y = b). From the SSSS exact displacement functions, one can observe that (ϕ_x) and (ϕ_y) yielded similar values though different displacement coefficients at the same points on the rectangular plate. Also ($\phi_x{}^{I}$) and ($\phi_y{}^{I}$) yielded similar values with different displacement coefficients at the same points on the rectangular plate while w and $w_{xy}{}^{II}$ did not yield similar value with any of the displacement functions but have similar displacement coefficient. This confirms the uniqueness and similarity of the SSSS plate being supported on all edges. Also, from Table 4.1a it is observed that there is rotation and no deflection at the edges of the SSSS rectangular thick anisotropic plate.

CCCC plate: The displacement functions ($\phi_x, \phi_y, w_{xy}{}^{II}$) yields zero at all the meaningful geometric points considered; edges (i.e. x = 0, y = 0 and x = a, y = b), edge – middle (i.e. x = 0 or a, y = b/2 points), middle – edge (i.e. x = a/2, y = 0 or b) and midspan (i.e. x = a/2, y = b/2) along both x and y directions of the thick orthotropic rectangular plate. While the displacement functions (w, $\phi_x{}^{I}$ and $\phi_y{}^{I}$) gave values (0.00390625A_1, -0.0625A_2 and -0.0625A_1) only at the middle geometric points (i.e. x = a/2, y = b/2) along both x and y directions of the thick rectangular orthotropic plate. Hence, CCCC plate does not rotate at any meaningful geometric point considered but exhibits deflection and moment at the center of the plate. However, these displacement functions ($\phi_x, \phi_y, w_{xy}{}^{II}$) yielded values when considered at the geometric points, (i.e. x = 0.2 or y = 0.2 or both x and y = 0.2) as the case may be.

CSSS plate: The displacement functions (w, ϕ_y, $\phi_x{}^{I}$and $\phi_y{}^{I}$) yielded (0.039062A_1, 0.039062A_3, -0.375A_2 and -0.46875A_3) at the geometric middle points (i.e. x = a/2 and y = b/2) along both x and y directions of the thick orthotropic rectangular plate. Hence, they cannot be applied to obtain meaningful values at the edge points (i.e. x = 0 or a and y = 0 or b point) and edge – middle points (i.e. x = 0 or a and y = b/2) or middle – edge points (i.e. x = a/2 and y = 0, b) along both x and y directions of the rectangular plate. The displacement functions ϕ_x values (0.125A_2) and the second derivative of displacement $w_{xy}{}^{II}$ values (0.125A_1) are valid at the geometric edge – middle points (i.e. x = 0, y = b/2) along both x and y directions of the rectangular plate but did not yield any result when considering other points like, middle points and edges along both x and y directions of the rectangular plate. Table 4.1a shows that there are deflections, rotations and moments at the geometric middle point of CSSS thick orthotropic rectangular plate.

CCSS plate; The displacement functions (w, ϕ_y, $\phi_x{}^{I}$and $\phi_y{}^{I}$) are only valid at the geometric middle points (i.e. x = a/2 and y = b/2) with values (0.015625A_1, 0.0390625A_3, -0.375A_2 and -0.46875A_3)

along both x and y directions of the thick orthotropic rectangular plate. Hence, they cannot be applied to obtain meaningful values at the geometric edge points, (i.e. x = 0 or a and y = 0 or b point) and edge – middle points (i.e. x = 0 or a and y = b/2) or middle – edge points (i.e. x = a/2 and y = 0, b) along both x and y directions of the rectangular plate. The displacement functions ϕ_x value ($0.125A_2$) and the second derivative of displacement $w_{xy}{}^{II}$ values ($0.125A_1$ & $0.5A_1$) are valid at the geometric edge – middle points (i.e. x = 0, y = b/2) along both x and y directions of the rectangular plate but did not yield any result when considering other points like, middle points and edges, along both x and y directions of the rectangular plate. Table 4.1a shows that there are deflections, rotations and moments at the geometric middle point of CCSS thick orthotropic rectangular plate. CCSS plate has similar force characteristic with CSSS plate.

CSCS plate: The displacement function (w) and the derivatives of displacement functions ($\phi_x{}^I$ and $\phi_y{}^I$) yield values, (0.01953125A_1, -0.1875A_2 and -0.3125A_3) at the geometric middle points, (i.e. x = a/2 and y = b/2) along both x and y directions of the thick anisotropic rectangular plate. Hence, they cannot be applied at the edge points, (i.e. x = 0, y = 0 and x = a, y = b) and edge – middle points (i.e. x = 0 or a and y = b/2 point) or middle – edge points (i.e. x = a/2 and y = 0 or b points) along both x and y directions of the CSCS thick anisotropic rectangular plates. The displacement function (ϕ_y) yields value ($0.3125A_3$) while the displacement functions ($w_{xy}{}^{II}$) did not yield meaningful value at the meaningful geometric points considered in Table (4.1a). Although, it yielded it maximum value when geometric points, (x = 0.2, y = 0.2) is considered. Also the displacement function (ϕ_x) is only valid at the geometric edge – middle points (i.e. x = 0 or a and y = b/2 points) with a value ($0.0625A_2$) along both x and y directions of the thick anisotropic rectangular plate and did not yield any meaningful value at the various geometric points; edge (i.e x = 0, y = 0 or x = a, y = b or x = 0, y = b or x = a, y = 0), middle – edge (i.e. x = a/2 and y = 0 or b) and middle (i.e. x = a/2 and y = b/2) along both x and y directions of the rectangular plate. The plate does not deflect at the geometric middle points but has moment and can rotate at that point.

CCCS plate: The displacement functions (w, ϕ_x) and the derivative of displacement functions, $\phi_x{}^I$, $\phi_y{}^I$ yield valid values (0.007813A_1, 0.007813A_2, -0.09375A_3 and -0.125A_3) at the geometric middle points, (i.e. x = a/2 and y = b/2) along both x and y directions of the thick anisotropic rectangular plate. Hence, they cannot be applied at the various geometric points; edge (i.e. x = 0, y = 0 and x = a, y = b) and edge – middle (x = 0, y = b/2 and x = a, y = b/2) or middle – edge (x = a/2, y = 0 and x= a/2, y = b) along both x and y directions of the thick anisotropic rectangular plate. The displacement function ϕ_y and $w_{xy}{}^{II}$ yields zero at all the meaningful geometric points considered in this work; (i.e. x = a, y = b or a = a/2, y = b/2 or x = 0, y = 0) along both x and y directions of the thick anisotropic rectangular plate. However, these displacement functions (ϕ_x, $\mathrm{w_{xy}}^{\mathrm{II}}$) yielded values when considered at the geometric points, (i.e. x = 0.2 or y = 0.2 or both x and y = 0.2) as the case may be. Hemce, this plate deflects and exhibit rotation and moment at the geometric middle points only.

SSFS plate: The displacement functions w and ϕ_y and the derivate of displacement functions $\phi_x{}^I$ and $\phi_y{}^I$ yields values ($0.28971354A_1$, $0.37109375A_3$, $-2.78125A_2$ and $-0.78125A_3$) only at the geometric middle points, (i.e. x = a/2, y = b/2) along both x and y directions of the rectangular thick anisotropic plate. Hence, they yield zero at every other meaningful geometric points; edge (i.e. x = 0, y = 0 or x = a, y = b), edge – middle (i.e. x= 0, y = b/2 or x = a, y = b/2) or middle – edge (i.e. x = a/2, y = 0 or x = a/2, y = b) along both x and y directions of the rectangular thick anisotropic plate. The displacement function ϕ_x yields value ($0.92708333A_2$) at the geometric edge-middle points (i.e. x = 0, y = b/2 or x = a, y = b/2) along both x and y directions of the thick anisotropic rectangular plate. The second derivate of displacement functions, $w_{xy}{}^{II}$ yield values, ($1.1875A_1$ and $0.666667A_1$) at various geometric points; edge – middle, (i.e. x = 0, y = b/2) and edges, (i.e. x = a and y = b or x = 0 and y = 0) along both x and y directions of SSFS thick anisotropic rectangular plate. Thus, SSFS thick anisotropic rectangular plates deflect, rotate and also exert moment at the middle span.

CCFC plate: The displacement functions (w and ϕ_y) and the derivative of displacement functions ($\phi_x{}^I$ and $\phi_y{}^I$) yield values, ($0.016015625A_1$, $0.02578125A_3$, $-0.25625A_2$ and $-0.0875A_3$) at the geometric middle points (i.e. x = a/2 and y = b/2) along both x and y directions of CCFC thick anisotropic rectangular plate. Hence, yield zero when applied at the edge points, (i.e. x = 0, y = 0 or x = a, y = b), edge – middle points, (i.e. x = 0, y = b/2 or x = a, y = b/2) or middle – edge points, (i.e. x = a/2, y = 0 or x = a/2, y = b) along both x and y directions of CCFC thick anisotropic rectangular plate. The second derivative of CCFC displacement function $w_{xy}{}^{II}$ and the displacement function (ϕ_y) yield zero at all the meaningful geometric points; edge-middle, (i.e. x = a, y = b/2), edges, (i.e. x = a, y = b), middle – edge, (i.e. x = a/2, y = b) and middle, (i.e. x = a/2, y = b/2) along both x and y directions of the rectangular thick anisotropic plate. However, these displacement functions (ϕ_y, $\mathrm{w_{xy}}^{\mathrm{II}}$) yielded values when considered at the geometric points, (i.e. x = 0.2 or y = 0.2 or both x and y = 0.2) as the case may be. Thus, there are deflections, rotations and moments at the geometric middle points for all the displacement functions considered.

SCFS plate: The displacement functions, (w, ϕ_x and ϕ_y) and the derivate of displacement functions, ${\phi_x}^I$ and ${\phi_y}^I$ yields values (0.1158854A_1, 0.1158854A_2, 0.1484375A_3, -1.390625A_2 and -0.3125A_3) only at the geometric middle points, (i.e. x = a/2 and y = b/2) along both x and y directions of SCFS thick anisotropic rectangular plate. Hence, they yield zero when applied at the edge points, (i.e. x = 0, y = 0 or x = a, y = b), edge – middle points, (i.e. x = 0, y = b/2 or x = a, y = b/2) or middle – edge points, (i.e. x = a/2, y = 0 or x = a/2, y = b) along both x and y directions of SCFS rectangular thick anisotropic plate. The second derivative of SCFS displacement function ${w_{xy}}^{II}$ only yield significant values, (10.1484375A_1 and -0.3333333A_1) at middle points, (i.e. x = a/2, y = b/2) and edge points, (i.e. x = a, y = b) along both x and y directions of the rectangular thick anisotropic plate. Thus the plate deflect, rotate and exert moments for all the displacement functions in SCFS.

CSFS plate: The displacement functions, w and ϕ_y, and the derivate of displacement functions, ${\phi_x}^I$ and ${\phi_y}^I$, yield values (0.080078125A_1, 0.15234375A_3, -0.76875A_2 and -0.34375A_3) only at the geometric middle points (i.e. x = a/2, y = b/2) along both x and y directions of CSFS thick anisotropic rectangular plate. Hence, they yield zero at the edge points, (i.e. x = 0, y = 0 or x = a, y = b), edge – middle points, (i.e. x = 0, y = b/2 or x = a, y = b/2) or middle – edge points, (i.e. x = a/2, y = 0 or x = a/2, y = b) along both x and y directions of CSFS thick anisotropic rectangular plate. The second derivative of CSFS displacement function ${w_{xy}}^{II}$ only yield significant values, (0.4875A_1 and 0.2A_1) at edge – middle points, (i.e. x = 0, y = b/2 or x = a, y = b/2) and edge points, (i.e. x = a, y = b) along both x and y directions of the rectangular thick anisotropic plate. Displacement functions, (ϕ_x) yields value, (0.25625A_2) only at the geometric edge – middle points, (i.e. x = 0, y = b/2 or x = a, y = b/2) along both x and y directions of CSFS thick anisotropic rectangular plate and cannot yield significant values when applied at any other point on the plate. Hence the plate can deflect, rotate and exert moment at the geometric middle points.

CCFS plate: The displacement functions, (w, ϕ_x and ϕ_y) and the derivate of displacement functions, ${\phi_x}^I$ and ${\phi_y}^I$ yield values, (0.03203125A_1, 0.03203125A_2, 0.0609375A_3, -0.384375A_2, -0.1375A_3) at the geometric middle points, (i.e. x = a/2, y = b/2) along both x and y directions of CCFS thick anisotropic rectangular plate. Hence, they cannot yield significant values when applied at the edge points, (i.e. x = 0, y = 0 or x = a, y = b) or edge – middle points, (i.e. x = 0, y = b/2 or x = a, y = b/2) or middle – edge points, (i.e. x = a/2, y = 0 or x = a/2, y = b) along both x and y directions of CCFS thick anisotropic rectangular plate. The second derivative of CCFS displacement function, ${w_{xy}}^{II}$ will only yield significant values, (0.0609375A_1 and -0.1A_1) at the various geometric points; middle, (i.e. x

= a/2, y = b/2) and edges, (i.e. x = a, y = b) along both x and y directions of the CCFS rectangular thick anisotropic plate. Hence, the most effective displacement functions for this plate cannot be determined at the edge points. Thus, the plate does not deflect or rotate at the edges but can exert moment at the edge (x = a and y = b).

SCFC plate: The displacement functions w and ϕ_y yield values, ($0.057942708A_1$ and $0.07421875A_3$) only at the geometric middle points (i.e. x = a/2, y = b/2) along both x and y directions of SCFC rectangular thick anisotropic plate. Hence, they cannot yield significant value when applied at the edge points, (i.e. x = 0, y = 0 or x = a, y = b) and edge – middle points, (i.e. x = 0, y = b/2 or x = a, y = b/2) or middle – edge points, (i.e. x = a/2, y = 0 or x = a/2, y = b) along both x and y directions of SCFC rectangular thick anisotropic plate. The derivative of SCFC displacement function, ${\phi_x}^I$ only yield values, (-$0.92708333A_2$ and$2.6666667A_2$) at middle points, (i.e. x = a/2, y = b/2) and edge points, (i.e. x = a, y = b) along both x and y direction of the thick anisotropic rectangular plate while the derivate of the displacement function ${\phi_y}^I$ can be applied to yield value, (-$0.15625A_3$) at all the points along x and y directions of SCFC thick anisotropic rectangular plate. Also, the displacement functions ϕ_x and ${w_{xy}}^{II}$ will not yield any significant value when applied at any of the meaningful points along both x and y directions of thick anisotropic rectangular plate. However, these displacement functions (ϕ_x, ${w_{xy}}^{II}$) yielded values when considered at the geometric points, (i.e. x = 0.2 or y = 0.2 or both x and y = 0.2) as the case may be. Thus, the plate does exert moment, deflection and rotations at most of the displacement functions considered.

4.2.3.2 Polynomial stiffness values (k) of the rectangular plates

The polynomial stiffness values (k) of the rectangular plate for the twelve boundary conditions considered here were the product of closed form integral of the displacement functions. The Equations and the values obtained are similar to those obtained by Ibearugbulem *et al.* (2014). Table (4.1b) showed that the polynomial stiffness values obtained for the various rectangular plate boundary conditions (SSSS, CCCC, CSSS, CCSS, CSCS, CCCS, SSFS, CCFC, CSFS and CCFS) yielded the same value, zero for, (k_4 and k_5). SCFS and SCFC rectangular plate boundary conditions yielded 0.1111 and 0.5625 for its (k_4) stiffness values. Thus, for the twelve boundary conditions considered, the stiffness values of k_5, yielded zero in all boundary conditions while k_4 yielded values for only two boundary conditions as stated above. These yield of the same values for (k_5) and most (k_4) confirmed the similarities in its Equations.

4.2.4 Formulas for determining the displacements and stresses

The combination of the elastic equations, displacement functions equations, stiffness equations, governing equations and the compatibility equation yielded the required formulas for the calculation of displacements and stresses. It can be seen from Equations (4.5) to (4.7) that the displacements follow similar pattern and they are generally related by the following terms $(\frac{k_8}{k_T})(\frac{\mathrm{a}}{\mathrm{t}})^3.\frac{\mathrm{q}}{E_0}$ where k_8 is the stiffness coefficient, $\frac{\mathrm{a}}{\mathrm{t}}$ is the ratio of span to thickness which is majorly used to classify the plate, q is the pure bending loading on the plate, E_0 is the elastic modulus, while k_T is a combination of different parameters as shown in chapter 3. The in-plane displacements u and v are more closely related, with the difference being the derivative $(\frac{\mathrm{dh}}{\mathrm{dR}}, \frac{\mathrm{dh}}{\mathrm{dQ}})$ and aspect ratio (P_2, P_3). When these displacement formulas are applied in a problem, the values obtained with the formulas of u and v are more closely related than the values obtained with the out-plane displacement w.

The in-plane stresses $(\sigma_{RR}, \sigma_{QQ}, \tau_{RQ})$ in Equations (4.8) to (4.10) also have some terms in common and those common terms which includes the derivative of "h" with respect to "R" and "Q" are as follows; $12\mathrm{qS}.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right)$, $\left[\mathrm{P}_2 - \frac{4}{3}\mathrm{P}_2 S^2 - 1\ \right].\frac{\partial^2 \mathrm{h}}{\partial R^2}$, $\left[\mathrm{P}_3 - \frac{4}{3}\mathrm{P}_3 S^2 - 1\ \right].\frac{\partial^2 \mathrm{h}}{\partial Q^2}$ and $\left[\mathrm{P}_2 + \mathrm{P}_3 - \frac{4}{3}\mathrm{P}_2 S^2 - \frac{4}{3}\mathrm{P}_3 S^2 - 2\right].\frac{\partial^2 \mathrm{h}}{\partial \mathrm{R}\partial Q}$. These common terms enhances the easy applicability of the developed formulas. The out-plane displacement (τ_{Rs} and τ_{Qs}) in Equations (4.11) and (4.12) also have common term which is $12\mathrm{q}.\left(\frac{\mathrm{k}_8}{\mathrm{k}_\mathrm{T}}\right)\left(\frac{\mathrm{a}}{\mathrm{t}}\right)^3$. Closer observation shows that the displacements (w, u and v) and out plane shear stresses (τ_{Rs} and τ_{Qs}) are related by the term $\left(\frac{\mathrm{k}_8}{\mathrm{k}_\mathrm{T}}\right)\left(\frac{\mathrm{a}}{\mathrm{t}}\right)^3$ and this will further ease the solution of this thick anisotropic rectangular plate through this method.

These common terms confirms our earlier submission that the method is less cumbersome and easy to apply when analyzing thick anisotropic rectangular plates. With these novel equations and formulas, the solution to rectangular thick anisotropic plate can be determined by simply substituting the equation data.

4.2.5 Example problem of typical anisotropic rectangular thick plate with different boundary conditions

A typical anisotropic rectangular thick plate problem was solved with the developed solution to ascertain its validity and correctness in analysing thick rectangular anisotropic plate problems. The problems chosen is a very familiar one that has been solved by several authors. This stands as advantage for easy comparison with the results from different authors. Below are discussions made based on different plate boundary conditions.

4.2.5.1 Numerical values of displacements and stresses for SSSS anisotropic rectangular thick plate

The numerical values of displacement and stresses for SSSS thick anisotropic rectangular plate were presented on Table 4.2a, 4.2b, 4.2c, 4.2d, 4.2e, 4.2f and 4.2g. The angle fibre orientation used are as follows: 0^0, 15^0, 30^0, 45^0, 60^0, 75^0 and 90^0 while the span to thickness ratio, α considered are 5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100. Also, the aspect ratio, β, is taken to be one (1). Although the solution can be varied for different geometric parameters if the need arises, only the listed geometric parameters were considered in Tables 4.2.

i. SSSS plate at angle fiber orientation of 0^0

From Table 4.2a, it is observed that out-plane displacement values $\overline{w}$ decreases as the thickness of the plate decreases. The decrease was very high at the thick plate zone (α = 5 to 10) but becomes very small at the thing plate zone (α = 50 to 100). This is a confirmation that the out-plane displacement act more on thick plate zone than thin plate zone in rectangular thick anisotropic plate. The in-plane displacements, $\bar{u}$ and $\bar{v}$, also decrease as the thickness of the plate decreases and become more noticeable at the thin plate section (α = 50 to 100). This shows that the in-plane displacements have a minimal effect on SSSS thick anisotropic plate.

The in-plane stresses, $\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$, decrease as the plate decreases in thickness. A close look will reveal a sharp decrease at thick and moderately thick plate section (α = 5 to 20) while at the thin plate section (α = 50 to 100), they decreased lightly. The out-plane stress, $\overline{\tau_{xz}}$, increases as the plate thickness decreases while the out-plane stress, $\overline{\tau_{yz}}$, decreases as the plate thickness decreases. This divergence in the progressive order of the plate values can be explained from the fact that anisotropic plates are plates with different resistance to mechanical actions in different directions. That is, they possess different properties in different directions.

ii. SSSS plate at angle fiber orientation of 15^0

Table 4.2b shows that out-plane displacement values, $\overline{\mathrm{w}}$, decreases as the thickness of the plate decreases. The decrease was higher at the thick plate zone, (α = 5 to 10) but becomes very small at the thin plate zone, (α = 50 to 100). This shows that the out-plane displacement act more on thick plate than thin plate. The in-plane displacements, $\bar{u}$ and $\bar{v}$, also decrease as the thickness of the plate decreases and become more noticeable at the thin plate section, (α = 30 to 100). This shows that the in-plane displacements is more effective to thin plate than thick plate.

The in-plane stresses, $\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$ decrease as the plate decreases in thickness. It is observed that the decrease is more noticeable at thick and moderately thick plate section, (α = 5 to 30) but moderate at the thin plate section, (α = 50 to 100). The values of out-plane stresses, $\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$, increase as the plate thickness decreases. This divergence in the progressive order of the plate values can be explained from the fact that anisotropic plates have different properties in different directions.

iii. SSSS plate at angle fiber orientation of 30^0

We observed from Table 4.2c that out-plane displacement values, $\bar{w}$, decreases as the thickness of the plate decreases. The decrease was higher at the thick plate zone, (α = 5 to 10) but gradually diminishes at the thin plate zone, (α = 50 to 100). This shows that the out-plane displacement act more on thick plate than thin plate for SSSS plate at angle fiber orientation of 30^0. The in-plane displacements, $\bar{u}$ and $\bar{v}$, also decrease as the thickness of the plate decrease and become more noticeable at the thin plate section, (α = 50 to 100). This shows that the in-plane displacements are more effective in thin plate than thick plate.

The in-plane stresses, $\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$ decrease as the plate thickness decreases. It is observed that the decrease is more noticeable at thick and moderately thick plate section, (α = 5 to 20) but moderate at the thin plate section, (α = 50 to 100). The values of out-plane stresses $\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$ increase as the plate thickness decreases. This divergence in the progressive order of the plate values can be explained from the fact that anisotropic plates have different properties in different directions.

iv. SSSS plate at angle fiber orientation of 45^0

It is observed from Table 4.2d that out-plane displacement values, $\bar{w}$, decreases as the thickness of the plate decreases. The decrease was high at the thick plate zone (α = 5 to 10) but gradually diminishes at the thin plate zone (α = 50 to 100). This shows that the out-plane displacement act more on thick plate than thin plate. The in-plane displacements, $\bar{u}$ and $\bar{v}$, also decrease as the thickness of the plate decreases and becomes more noticeable at the thin plate section, (α = 50 to 100). This shows that the in-plane displacements are more effective in thin plate than thick plate.

The in-plane stresses, $\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$ and the out-plane stresses $\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$ increase as the plate thickness decreases. This increase in stresses as the plate thickness decreases are very obvious at the thick plate section (α = 5 to 10) but gradually decreases as the thickness of the plate decreases. One unique observation at this angle fiber orientation of 45^0 is that both the out-plane and the in-plane displacements decrease as the plate thickness increases while both the out-plane and the in-plane stresses increase as the plate thickness decreases. So at angle 45^0 for SSSS plate the displacements decrease while the stresses increase as thickness of the plate decreases.

v. SSSS plate at angle fiber orientation of 60^0

Table 4.2e shows that out-plane displacement values $\overline{w}$ decreases as the thickness of the plate decreases. The decrease was very high at the thick plate zone (α = 5 to 10) but gradually diminishes at the thin plate zone (α = 50 to 100). This shows that the out-plane displacement act more on thick plate than thin plate. The in-plane displacements, $\overline{u}$ and $\overline{v}$, also decrease as the thickness of the plate decreases and become more noticeable at the thin plate section, (α = 50 to 100). This shows that the in-plane displacements are more effective in thin plate than thick plate.

The values of the in-plane stresses, $\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$, and the out-plane stresses, $\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$, increase as the plate thickness decreases while the values of the in-plane stress, $\overline{\tau_{xy}}$, decreases as the thickness of the plate decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section but gradually decrease or increase as the thickness of the plate decreases. One unique observation at this angle fiber orientation of 60^0 is that both the out-plane and the in-plane displacements decrease as the plate thickness increases while both the out-plane and the in-plane stresses increase as the plate thickness decreases except the values of the in-plane stress, $\overline{\tau_{xy}}$, which decreases as the plate thickness decreases.

vi. SSSS plate at angle fiber orientation of 75^0

We observed from Table 4.2f that out-plane displacement values, $\overline{w}$, decreases as the thickness of the plate decreases. The decrease was very visible at the thick and moderate thick plate zone, (α = 5 to 40) but gradually diminishes at the thin plate zone, (α = 50 to 100). This shows that the out-plane displacement act more on thick plate than thin plate. The in-plane displacements, $\overline{u}$ and $\overline{v}$, also decreases as the thickness of the plate decrease and become more noticeable at the thin plate section. This shows that the in-plane displacements are more effective in thin plate than thick plate.

The in-plane stresses, $\overline{\sigma_{xx}}$ and $\overline{\tau_{xy}}$, decrease in values as the plate thickness decreases while the values of the in-plane stress, $\overline{\sigma_{yy}}$ and out-plane stresses, $\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$, increase as the plate thickness decreases.

This divergence in the progressive order of the plate values can be explained from the fact that anisotropic plates have different properties in different directions.

vii. SSSS plate at angle fiber orientation of 90^0

Table 4.2e shows that out-plane displacement values, $\overline{w}$, decreases as the thickness of the plate decreases. The decrease was very visible at the thick and moderate thick plate zone, (α = 5 to 40) but gradually diminishes at the thin plate zone, (α = 50 to 100). This shows that the out-plane displacement act more on thick plate than thin plate for SSSS plate at 90^0 angle fiber orientation. The values of the in-plane displacements, $\overline{u}$ and $\overline{v}$, also decrease as the thickness of the plate decreases and becomes more noticeable at the thin plate section, (α = 50 to 100). This shows that the in-plane displacements are more effective in thin plate than thick plate.

The values of the in-plane stresses, $\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$and the out-plane stress, $\overline{\tau_{xz}}$, decrease as the plate thickness decreases while the values of the out-plane stress, $\overline{\tau_{yz}}$, increases as the thickness of the plate decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10) but gradually diminishes as the thickness of the plate decreases. One unique observation at this angle fiber orientation of 90^0 is that both the out-plane, in-plane displacements and stresses values decrease as the plate thickness decreases except the values of the in-plane stress, $\overline{\tau_{xy}}$, which decreases as the plate thickness decreases.

viii. SSSS plate variation of displacements and rotation with angle fibre orientation

The values of displacements, (w, u, v), for, 0^0, angle fibre orientation, β = 1, α = 5, (0.0180, -0.32005, -0.60615) and, α = 100, (0.00698, -111.216, -111.608) were as given. These values at, α = 5 and α = 100, yielded differences, (w = 0.01102, u = 110.89595, v = 111.00185). It yielded differences of, (w = 0.006667, u = 91.9578, v = 92.0057), at 15^0, and differences of, (w = 0.00343, u = 68.57382, v = 68.48086), at 30^0. The differences obtained at, 45^0, 60^0, 75^0, and 90^0, are as follows; (w = 0.00297, u = 60.88813, v = 60.694773), (w = 0.00464, u = 68.74922, v = 68.426313), (w = 0.01101, u = 92.38146, v = 91.910177) and (w = 0.02161, u = 111.34903, v = 110.921208) respectively. It is observed from the differences that the values of the displacements (w,u,v) decreases as the angle fiber orientation increases and changed trend at 60^0, angle fiber orientation and started increasing up till 90^0, angle fiber orientation as shown above.

4.2.5.2 Numerical values of displacements and stresses for CCCC anisotropic rectangular thick plate

The numerical values of displacements and stresses of CCCC anisotropic rectangular thick plate were tabulated on Tables 4.3a, 4.3b, 4.3c, 4.3d, 4.3e, 4.3f and 4.3g. The angle fibre orientation used are as follows: 0^0, 15^0, 30^0, 45^0, 60^0, 75^0 and 90^0 while the span to thickness ratio, α, considered are 5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100. Also, the aspect ratio, β, is taken to be one (1.5). Although the solution can be varied for different geometric parameters if the need arises, only the listed geometric parameters were considered in Tables 4.3. The CCCC plate yielded zero at the mid-span/edges for all of its in-plane displacements ($\bar{u}$ and $\bar{v}$), in-plane stress ($\overline{\tau_{xy}}$) and out-plane stresses ($\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$). This is because, the plate does not rotate, deflect or exert moment at the mid-span/edges. Hence the aspect ratio, β = 0.2 was adopted and it yielded the maximum analytical values for the listed stresses and displacements.

i. CCCC plate at angle fiber orientation of 0^0

From Table 4.3a, it is observed that the values of displacements, ($\bar{w}$, $\bar{u}$, $\bar{v}$), and stresses, ($\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), decrease as the thickness of the plate decreases. At the minimum span to thickness ratio, α = 5, the displacements, ($\bar{w}$, $\bar{u}$, $\bar{v}$), and stresses, ($\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yields, (0.01349, -0.13438, -0.26688) and (0.03285, 0.04710), while at the maximum span to thickness ratio, α = 100, the displacements ($\bar{w}$, $\bar{u}$, $\bar{v}$), and stresses ($\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yields, (0.00164, -24.71141, -16.74480) and (0.00765, 0.01187) respectively. The in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), increase as the thickness of the plate decreases. Their values at minimum and maximum thickness, α = 5 and α = 100 are (-0.02330, -0.00145, 0.57552), and (-0.01062, -0.00030, 0.65321), respectively. These decrease/increase were high at the thick and moderate thick plate zone (α = 5 to 20) but becomes smaller at the thin plate zone (α = 50 to 100). This is a confirmation that the displacement of CCCC plate at 0^0 angle fiber orientation act more on thick plate than on thin plate.

ii. CCCC plate at angle fiber orientation of 15^0

Table 4.3b shows that displacements, ($\bar{w}$, $\bar{u}$, $\bar{v}$), and shear stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), decrease as the thickness of the plate decreases. It yields, (0.01704, -0.16094, -0.31905) and (0.16179, 0.74015, 0.07032), at α = 5 and also yield, (0.00177, -26.72582, -18.05267) and (0.03524, 0.64926, 0.03186) at α = 100. The decrease were high at the thick and moderately thick plate zone (α = 5 to 40) but becomes very small at the thin plate zone (α = 50 to 100). The in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), for CCCC plate at 15^0 angle fiber orientation yield, (-0.31784, -0.02747) and (-0.07163, -0.00605) at α = 5 and 100 respectively. This shows that the in-plane stresses increase as the thickness of the plate decreases. However, these decrease/increase of displacements and stresses are more active at the thick plate zone, (α = 5 to 20).

iii. CCCC plate at angle fiber orientation of 30^0

From Table 4.3c it was noted that displacements, $(\overline{w}, \overline{u}, \overline{v})$, and shear stresses, $(\overline{\tau_{xy}}, \overline{\tau_{xz}}, \overline{\tau_{yz}})$, decrease as the thickness of the plate decreases. It yields, (0.03572, -0.29479, -0.58125) and (0.72773, 1.61547, 0.19996), at α = 5 and also, (0.00221, -33.55198, -22.48122) and (0.10677, 0.62940, 0.09990), at α = 100. The decrease were high at the thick and moderately thick plate zone (α = 5 to 40) but becomes very small at the thin plate zone (α = 50 to 100). The in-plane stresses, $(\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}})$, for CCCC plate at 30^0 angle fiber orientation yield, (-0.78345, -0.27034) and (-0.11649, -0.03996) at α = 5 and 100 respectively. This shows that the in-plane stresses increase as the thickness of the plate decreases. However, these decrease/increase of displacements and stresses for CCCC plate at angle fiber orientation of 30^0 are more active at the thick plate zone, (α = 5 to 20).

iv. CCCC plate at angle fiber orientation of 45^0

From Table 4.3d, it was noted that displacements, $(\overline{w}, \overline{u}, \overline{v})$, and shear stresses, $(\overline{\tau_{xy}}, \overline{\tau_{xz}}, \overline{\tau_{yz}})$, decrease as the thickness of the plate decreases. These decrease in the values of displacements and stresses yields, (0.06904, -0.56067, -0.86875) and (1.51050, 3.13588, 0.53925), at α = 5 and also yield, (0.00311, -47.34357, -31.41726) and (0.19248, 0.56688, 0.23824), at α = 100. The decrease were high at the thick and moderately thick plate zone (α = 5 to 40) but becomes very small at the thin plate zone (α = 50 to 100) except for out-plane stress, $(\overline{\tau_{yz}})$, where the values decreased at the thick plate zone, (α = 5 to 10), but increased at moderate thick and thin plate zone, (α = 20 to 100). The in-plane stresses, $(\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}})$, for CCCC plate at 45^0 angle fiber orientation yield, (-0.97001, -0.97014) and (-0.12434, -0.12389), at α = 5 and 100 respectively. This shows that the in-plane stresses increase as the thickness of the plate decreases. However, these decrease/increase of displacements and stresses for CCCC plate at angle fiber orientation of 45^0 are more visible at the thick plate zone, (α = 5 to 20).

v. CCCC plate at angle fiber orientation of 60^0

Table 4.3e shows that the values of displacements, $(\overline{w}, \overline{u}, \overline{v})$, and shear stresses, $(\overline{\tau_{xy}}, \overline{\tau_{xz}}, \overline{\tau_{yz}})$, decrease as the thickness of the plate decreases. These decrease in the values of displacements and stresses yields, (0.03562, -0.48056, -0.29559) and (0.57755, 1.33066, 0.36971), at α = 5 and also (0.00453, -69.25583,

-45.59342) and (0.21513, 0.42454, 0.45949), at α = 100. The decrease were high at the thick and moderately thick plate zone, (α = 5 to 40), but becomes very small at the thin plate zone, (α = 50 to 100) except for out-plane stress, ($\overline{\tau_{yz}}$), where the values decreased at the thick plate zone, (α = 5 to 10) but increased at moderate thick and thin plate zone, (α = 20 to 100). The in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), for CCCC plate at 60^0 angle fiber orientation yields, (-0.21602, -0.62236) and (-0.08043, -0.23186), at α = 5 and 100 respectively. This shows that the in-plane stresses increase as the thickness of the plate decreases. However, these decrease/increase of displacements and stresses for CCCC plate at angle fiber orientation of 60^0 are more visible at the thick plate zone, (α = 5 to 20).

vi. CCCC plate at angle fiber orientation of 75^0

From Table 4.3f, it was observed that displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and shear stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases. The decrease in the plate values yields, (0.02750, -0.66753, -0.17555) and (0.23217, 0.58255), at α = 5 and also (0.00602, -92.38325, -60.53263) and (0.11556, 0.22829), at α = 100. The decrease were high at the thick and moderately thick plate zone, (α = 5 to 40) but becomes very small at the thin plate zone (α = 50 to 100). The in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$) and out-plane stress, ($\overline{\tau_{yz}}$), for CCCC plate at 75^0 angle fiber orientation yields, (-0.0414, -0.44927, 0.31703) and (-0.02012, -0.22638, 0.69460), at α = 5 and 100 respectively. This shows that the in-plane stresses increase as the thickness of the plate decreases. However, these decrease/increase of displacements and stresses for CCCC plate at angle fiber orientation of 75^0 are more visible at the thick plate zone, (α = 5 to 20).

vii. CCCC plate at angle fiber orientation of 90^0

Table 4.3g, shows that displacements, ($\overline{w}$, $\overline{v}$), and stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{yz}}$), decrease as the thickness of the plate decreases. At the minimum span to thickness ratio, α = 5, the displacements, ($\overline{w}$, $\overline{v}$), and stresses ($\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yields, (0.00266, -0.05007) and (0.00624, 0.01074), while at the maximum span to thickness ratio, α = 100, the displacements ($\overline{w}$, $\overline{v}$), and stresses ($\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yields, (0.00032, -3.24718) and (0.00148, 0.00267) respectively. The in-plane displacement, ($\overline{u}$), and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xz}}$), increase as the thickness of the plate decreases. Their values at minimum and maximum thickness, α = 5 and α = 100 are (-0.02646, -0.00458, 0.00027, 0.11327), and (-4.79300, -0.00206, -0.00006, 0.12668), respectively. These decrease/increase in displacements and stresses values are high at the thick and moderate thick plate zone, (α = 5 to 20), but becomes smaller at the thin plate zone, (α = 50 to 100).

This is a confirmation that the displacement of CCCC plate at 90^0 angle fiber orientation act more on thick plate than on thin plate.

viii. CCCC plate variation of displacements and rotation with angle fibre orientation

The values of CCCC displacements, (w, u, v), for, 0^0, angle fibre orientation, β = 1.5, α = 5, (0.01349, -0.3438, -0.26688) and, α = 100, (0.00164, -24.71141, -16.74480) were as given. These values at, α = 5 and α = 100, yielded differences, (w = 0.01185, u = 24.57703, v = 16.47792). It also yielded differences of, (w = 0.01527, u = 26.56488, v = 17.73362), at 15^0, and differences of, (w = 0.03351, u = 33.25719, v = 21.89997), at 30^0. The differences obtained at, 45^0, 60^0, 75^0, and 90^0, are as follows; (w = 0.06593, u = 46.7829, v = 30.54851), (w = 0.03109, u = 68.77527, v = 45.29783), (w = 0.02148, u = 91.71572, v = 60.35708) and (w = 0.02261, u = 101.45984, v = 66.75829) respectively. It is observed from the differences that the values of the displacements (w,u,v) for CCCC plate boundary condition increases as the angle fiber orientation increases and changed trend at 60^0, angle fiber orientation and started decreasing up till 75^0, angle fiber orientation before changing trend again and increased at 90^0, angle fibre orientation as shown above. The in-plane displacements, (u,v), increases as the angle fiber orientation increases from 0^0, to 90^0, angle fiber orientation.

4.2.5.3 Numerical values of displacements and stresses for CSSS anisotropic rectangular thick plate

The numerical values of displacements and stresses for CSSS anisotropic rectangular thick plate are presented on Table 4.4a, 4.4b, 4.4c, 4.4d, 4.4e, 4.4f and 4.4g. The angle fibre orientation used are as follows: 0^0, 15^0, 30^0, 45^0, 60^0, 75^0 and 90^0 while the span to thickness ratio, α, considered are 5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100. Also, the aspect ratio, β, is taken to be one (1). The solution can be varied for different geometric parameters if the need arises, only the listed boundary conditions were considered.

i. CSSS plate at angle fiber orientation of 0^0

Table 4.4a shows that out-plane displacement values, $\overline{w}$, decreases as the thickness of the plate decreases. The decrease is high at the thick plate zone, (α = 5 to 10) but gradually diminishes at the thin plate zone, (α = 50 to 100). This shows that the out-plane displacement act more on thick plate than on thin plate. The values of the in-plane displacement, ($\overline{u}$ and $\overline{v}$), also decrease as the thickness of the plate decreases and becomes more noticeable at the thin plate section, (α = 50 to 100). This shows that the in-plane displacements are more effective in thin plate than on thick plate.

The values of the in-plane stresses, $\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$, and out-plane stress, $\overline{\tau_{yz}}$, decrease as the plate thickness decreases while the values of the out-plane stress, $\overline{\tau_{xz}}$, increases as the thickness of the plate decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decrease as the thickness of the plate decreases. One unique observation at this angle fiber orientation of 0^0 is that both the values of displacement and stresses decrease as the plate thickness decreases except the values of the out-plane stress, $\overline{\tau_{xz}}$, which increases as the plate thickness decreases.

ii. CSSS plate at angle fiber orientation of 15^0

Table 4.4a shows that out-plane displacement values, ($\overline{w}$), in-plane displacements, ($\overline{u}$ and $\overline{v}$) and in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$and $\overline{\tau_{xy}}$), decrease as the thickness of the plate decreases. The decrease was very visible at the thick plate zone, (α = 5 to 10), but gradually diminishes at the thin plate zone, (α = 50 to 100). This shows that the out-plane displacement, in-plane stresses and in-plane displacements of CSSS plate at angle fiber orientation of 15^0 act more on thick plate than on thin plate.

The values of the out-plane stresses, ($\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$), increase as the plate thickness decreases. This increase in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10) but gradually decreases as the thickness of the plate decreases. One unique observation on this CSSS plate at angle fiber orientation of 15^0 is that both the values of the out-plane stresses ($\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$) increase as the plate thickness decreases while the values of the in-plane stresses and displacements decrease with decrease in the plate thickness.

iii. CSSS plate at angle fiber orientation of 30^0

From Table 4.4c, it is observed that values of out-plane displacement, ($\overline{w}$), in-plane displacements, ($\overline{u}$ and $\overline{v}$), and in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), decrease as the thickness of the plate decreases. The decrease was high at the thick plate zone, (α = 5 to 10), but gradually diminishes as the thickness move towards thin plate zone, (α = 50 to 100). This shows that the out-plane displacement and in-plane principal stresses of CSSS plate at angle fiber orientation of 30^0 have more effect on thick plate than thin plate.

The values of the out-plane stresses, (τ_{xz} and τ_{yz}), and in-plane stress, ($\overline{\tau_{xy}}$), increase as the plate thickness decreases. This increase in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 50 to 100), but gradually decrease as the thickness of the plate decreases. One unique observation on this CSSS plate at angle fiber orientation of 30^0 is that all the displacements, ($\overline{w}$, $\overline{u}$ and $\overline{v}$), and the principal stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), acting on the plate decrease as the thickness of the plate decreases while all the shear stresses, ($\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$, $\overline{\tau_{xy}}$), acting on the plate increase as the thickness of the plate decreases.

iv. CSSS plate at angle fiber orientation of 45^0

Table 4.4d shows that the values of out-plane displacement, ($\overline{w}$), in-plane displacements, ($\overline{u}$ and $\overline{v}$) and in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$), decrease as the thickness of the plate decreases. The decrease was very visible at the thick plate zone, (α = 5 to 10) but gradually diminishes at the thin plate zone, (α = 50 to 100). This shows that the out-plane displacement, in-plane stresses and in-plane displacements of CSSS plate at angle fiber orientation of 45^0 have more impact on thick plate than on thin plate.

The values of the out-plane stresses, ($\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$), increases as the plate thickness decreases. This increase in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10) but gradually decrease as the thickness of the plate decreases. One unique observation at this angle fiber orientation of 45^0 is that both the values of the out-plane stresses, ($\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$), increase as the plate thickness decreases while the values of the in-plane stresses and displacements decreases as the plate thickness decreases.

v. CSSS plate at angle fiber orientation of 60^0

From Table 4.4e, it is observed that the values of out-plane displacement, ($\overline{w}$), in-plane displacements, ($\overline{u}$ and $\overline{v}$) and in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$), decrease as the thickness of the plate decreases. The decrease in values was very visible at the thick plate zone, (α = 5 to 10) but gradually diminishes at the thin plate zone, (α = 50 to 100). This shows that the out-plane displacement, in-plane stresses and in-plane displacements of CSSS plate at angle fiber orientation of 60^0 have more impact on thick plate than thin plate.

The values of the out-plane stresses, ($\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$), increase as the plate thickness decreases. This increase in stresses as the plate thickness decreases are very obvious at the thick plate section but gradually decrease as the thickness of the plate decreases. One unique observation on this CSSS plate angle fiber orientation of 60^0 is that both the values of the out-plane stresses ($\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$) increase as the plate thickness decreases while the values of the in-plane stresses and displacements decrease as the plate thickness decreases.

vi. CSSS plate at angle fiber orientation of 75^0

Table 4.4f, shows that the values of out-plane displacement, ($\overline{w}$), in-plane displacements, ($\overline{u}$ and $\overline{v}$) and in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$), decrease as the thickness of the plate decreases. The decrease in values were very visible at the thick plate zone, (α = 5 to 10) but gradually diminishes at the thin plate zone, (α = 50 to 100). This shows that the out-plane displacement, in-plane stresses and in-plane displacements of CSSS plate at angle fiber orientation of 75^0 have more impact on thick plate than thin plate.

The values of the out-plane stress, $\overline{\tau_{xz}}$, increased at aspect ratio of, (α = 5 to 10) and then decreased at aspect ratio of, (α = 20 to 100), as the plate thickness decreases while the values of out-plane stress, $\overline{\tau_{yz}}$, increases as the plate thickness decreases.

vii. CSSS plate at angle fiber orientation of 90^0

Table 4.4g shows that out-plane displacement values, ($\overline{w}$), decreases as the thickness of the plate decreases. The decrease is very visible at the thick plate zone, (α = 5 to 10), but gradually diminishes at the thin plate zone, (α = 50 to 100). This shows that the out-plane displacement act more on thick plate than thin plate. The values of the in-plane displacements, ($\overline{u}$ and $\overline{v}$), also decrease as the thickness of the plate decreases and becomes more noticeable at the thin plate section, (α = 50 to 100). This shows that the in-plane displacements are more effective in thin plate than thick plate.

The values of the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$and $\overline{\tau_{xy}}$), and the out-plane stress, ($\overline{\tau_{xz}}$), decrease as the plate thickness decreases while the values of the out-plane stress, ($\overline{\tau_{yz}}$), increases as the thickness of the plate decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decreases as the thickness of the plate decreases. One common observation on this CSSS plate at angle fiber orientation of 90^0 is that both the values of displacements and stresses decrease as the plate thickness decreases except the values of the out-plane stress, ($\overline{\tau_{yz}}$), which increases as the plate thickness decreases.

viii. CSSS plate variation of displacements and rotation with angle fibre orientation

The values of CSSS displacements, (w, u, v), for, 0^0, angle fibre orientation, β = 1, α = 5, (0.04028, -0.2879082, -0.14667) and, α = 100, (0.001605, -102.30411, -32.0665) were as given. These values at, α = 5 and α = 100, yielded differences, (w = 0.02423, u = 102.016502, v = 31.91983). It also yielded differences of, (w = 0.01573, u = 81.995395, v = 25.640694), at 15^0, and differences of, (w = 0.01037, u = 57.0782116, v = 17.809713), at 30^0. The differences obtained at, 45^0, 60^0, 75^0, and 90^0, are as follows; (w = 0.011697, u = 45.62696, v = 14.192985), (w = 0.017907, u = 43.510476, v = 13.482424), (w = 0.033396, u = 46.094396, v = 14.26197) and (w = 0.050577, u = 47.994391, v = 14.873895) respectively. It is observed from the differences that the values of the out-plane displacement, (w), for CSSS plate boundary condition decreases as the angle fiber orientation increases and changed trend at 30^0, angle fiber orientation and started increasing up till 90^0, as shown above. The in-plane displacements, (u,v), decreases as the angle fiber orientation increases and changed trend at 60^0, angle fiber orientation and increased till 90^0, angle fiber orientation.

4.2.5.4 Numerical values of displacement and stresses for CCSS anisotropic rectangular thick plate

The numerical values of displacements and stresses for CCSS anisotropic rectangular thick plate are tabulated in Table 4.5a, 4.5b, 4.5c, 4.5d, 4.5e, 4.5f and 4.5g. The angle fibre orientation used are as follows: 0^0, 15^0, 30^0, 45^0, 60^0, 75^0 and 90^0 while the span to thickness ratio, α, considered are 5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100. Also, the aspect ratio, β, is taken to be one (1). The solution can be varied for different geometric plate properties if the need arises, only the listed boundary conditions were considered.

i. CCSS plate at angle fiber orientation of 0^0

From Table 4.5a, the out-plane displacement values of, ($\overline{w}$), decreases as the thickness of the plate decreases. The decrease in values were very visible at the thick plate zone (α = 5 to 10) but gradually diminishes at the thin plate zone, (α = 50 to 100). This shows that the out-plane displacement act more on thick plate than on thin plate. The values of the in-plane displacements, ($\overline{u}$ and $\overline{v}$), also decrease as the thickness of the plate decreases and becomes more noticeable at the thin plate section, (α = 50 to 100). This shows that the in-plane displacements are more effective on thin plate than on thick plate.

The values of the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$), and the out-plane stress, ($\overline{\tau_{yz}}$), decrease as the plate thickness decreases while the values of the out-plane stress, ($\overline{\tau_{xz}}$), increases as the thickness of the plate decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decrease as the thickness of the plate decreases. One common observation at this angle fiber orientation of 0^0 is that both the values of displacements and stresses decreases as the plate thickness decreases except the values of the out-plane stress, ($\overline{\tau_{xz}}$), which increases as the plate thickness decrease

i. CCSS plate at angle fiber orientation of 15^0

From Table 4.5b, it is observed that the values of out-plane displacement, ($\overline{w}$), in-plane displacements, ($\overline{u}$ and $\overline{v}$), and in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$), decrease as the thickness of the plate decreases. The decrease in values were very visible at the thick plate zone, (α = 5 to 10), but gradually diminishes at the thin plate zone, (α = 50 to 100). This shows that the out-plane displacement, in-plane stresses and in-plane displacements of CCSS plate at angle fiber orientation of 15^0 have more impact on thick plate than thin plate.

The values of the out-plane stresses, ($\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$), increase as the plate thickness decreases. This increase in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decreases as the thickness of the plate decreases. One unique observation at this CCSS plate angle fiber orientation of 15^0 is that both the values of the out-plane stresses ($\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$) increase as the plate thickness decreases while the values of the in-plane stresses and displacements decrease as the plate thickness decreases.

iii. CCSS plate at angle fiber orientation of 30^0

Table 4.5c shows that the values of out-plane displacement, ($\overline{w}$), in-plane displacements, ($\overline{u}$ and $\overline{v}$), and in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$), decrease as the thickness of the plate decreases. The decrease in values were very visible at the thick plate zone, (α = 5 to 10), but gradually diminishes at the thin plate zone, (α = 50 to 100). This shows that the out-plane displacement, in-plane stresses and in-plane displacements of CCSS plate at angle fiber orientation of 30^0 have more impact on thick plate than on thin plate. Also the in-plane displacements, ($\overline{u}$ and $\overline{v}$), have closely related values at all the aspect ratio and its graph followed the same pattern.

The values of the out-plane stresses, ($\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$), increase as the plate thickness decreases. This increase in stresses as the plate thickness decreases are obvious at the thick plate section, (α = 5 to 10), but gradually decrease as the thickness of the plate decreases. One common observation at this angle fiber orientation of 30^0 is that both the values of the out-plane stresses, ($\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$), increase as the plate thickness decreases while the values of the in-plane stresses and displacements decrease as the plate thickness decreases.

iv. CCSS plate at angle fiber orientation of 45^0

From Table 4.5d, the values of out-plane displacement, ($\overline{w}$), and in-plane displacements, ($\overline{u}$, $\overline{v}$), decrease as the thickness of the plate decreases. The decrease in values were very visible at the thick plate zone, (α = 5 to 10), but gradually diminishes at the thin plate zone, (α = 50 to 100). This shows that the displacements of CCSS plate at angle fiber orientation of 45^0 have more impact on thick plate than on thin plate. Also the in-plane displacements, ($\overline{u}$ and $\overline{v}$), have closely related values at all the aspect ratio.

The values of the out-plane stresses, ($\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$), and in-plane principal stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), increase as the plate thickness decreases while the values of the in-plane shear stress, ($\overline{\tau_{xy}}$), decreases as the thickness of the plate decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decrease as the thickness of the plate decreases. One common observation at this angle fiber orientation of 45^0 is that both the values of the out-plane stresses, ($\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$), and the in-plane principal stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), increase as the plate thickness decreases while the values of the in-plane shear stresses, ($\overline{\tau_{xy}}$), and the displacements decrease as the plate thickness decreases.

v. CCSS plate at angle fiber orientation of 60^0

Table 4.5e shows that the values of out-plane displacement, ($\overline{w}$), and in-plane displacements, ($\overline{u}$, $\overline{v}$), decrease as the thickness of the plate decreases. The decrease in values were very visible at the thick plate section, (α = 5 to 10), but gradually diminishes at the thin plate section, (α = 50 to 100). This shows that the displacements of CCSS plate at angle fiber orientation of 60^0 have more impact on thick plate than on thin plate. Also the in-plane displacements, ($\overline{u}$ and $\overline{v}$), have closely related values at all the aspect ratio.

The values of the out-plane stresses, ($\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$), and the in-plane principal stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), increase as the plate thickness decreases while the values of the in-plane shear stress, ($\overline{\tau_{xy}}$), decreases as the thickness of the plate decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decreases as the thickness of the plate decreases. One common observation at this angle fiber orientation of 60^0 is that both the values of the out-plane stresses, ($\overline{\tau_{xz}}$and $\overline{\tau_{yz}}$), and the in-plane principal stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), increase as the plate thickness decreases while the values of the in-plane shear stresses, ($\overline{\tau_{xy}}$), and the displacements decrease as the plate thickness decreases.

vi. CCSS plate at angle fiber orientation of 75^0

From Table 4.5f, the out-plane displacement values, ($\overline{w}$), decreases as the thickness of the plate decreases. The decrease in values were very visible at the thick plate zone, (α = 5 to 10), but gradually diminishes at the thin plate zone, (α = 50 to 100). This shows that the out-plane displacement act more on thick plate than on thin plate. The in-plane displacements, ($\overline{u}$, $\overline{v}$), have close values at all the aspect ratio and also decrease as the thickness of the plate decreases.

The values of the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$), and the out-plane stress, ($\overline{\tau_{xz}}$), decrease as the plate thickness decreases while the values of the out-plane stress, ($\overline{\tau_{yz}}$), increases as the thickness of the plate decreases. This increase or decrease in stress values as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decreases as the thickness of the plate decreases. One common observation at this angle fiber orientation of 75^0 is that both the values of displacements and stresses decrease as the plate thickness decreases except for the values of the out-plane stress, ($\overline{\tau_{yz}}$), which increases as the plate thickness decreases.

vii. CCSS plate at angle fiber orientation of 90^0

From Table 4.5g, it is observed that the out-plane displacement values of ($\overline{w}$) decreases as the thickness of the plate decreases. The decrease in values were very visible at the thick plate zone, (α = 5 to 10), but gradually diminishes at the thin plate zone. This shows that the out-plane displacement act more on thick plate than on thin plate. The in-plane displacements, ($\overline{u}$, $\overline{v}$) have close values at all the aspect ratio and also decrease as the thickness of the plate decreases.

The values of the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$) and the out-plane stress, ($\overline{\tau_{xz}}$), decrease as the plate thickness decreases while the values of the out-plane stress, ($\overline{\tau_{yz}}$), increases as the thickness of the plate decreases. This increase or decrease in stress values as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decreases as the thickness of the plate decreases. One common observation at this angle fiber orientation of 90^0 is that both the values of out-plane and the in-plane displacements and stresses decrease as the plate thickness decreases except the values of the out-plane stress, ($\overline{\tau_{yz}}$), which increases as the plate thickness decreases.

viii. CCSS plate variation of displacements and rotation with angle fibre orientation

The values of CCSS displacements, (w, u, v), for, 0^0, angle fibre orientation, β = 1, α = 5, (0.075423, -0.0497670, -0.111938) and, α = 100, (0.02423, -14.186843, -14.29507) were as given. These values at, α = 5 and α = 100, yielded differences, (w = 0.057531, u = 14.137076, v = 14.183132). It also yielded differences of, (w = 0.042511, u = 13.24746, v = 13.280932), at 15^0, and differences of, (w = 0.026839, u = 11.77571, v = 11.763185), at 30^0. The differences obtained at, 45^0, 60^0, 75^0, and 90^0, are as follows; (w = 0.023969, u = 11.1847525, v = 11.11557526), (w = 0.034334, u = 11.866118, v = 11.7392323), (w = 0.066558, u = 13.409978, v = 13.245716) and (w = 0.103385, u = 14.304327, v = 14.149373) respectively. It is observed from the differences that the values of the displacements (w,u,v) for CCSS plate boundary condition decreases as the angle fiber orientation increases and changed trend at 60^0, angle fiber orientation and started increasing up till 90^0, angle fiber orientation as shown above.

4.2.5.5 Numerical values of displacements and stresses for CSCS anisotropic rectangular thick plate

The numerical values of displacements and stresses for CSCS anisotropic rectangular thick plate were tabulated on Table 4.6a, 4.6b, 4.6c, 4.6d, 4.6e, 4.6f and 4.6g. The angle fibre orientation used are as follows: 0^0, 15^0, 30^0, 45^0, 60^0, 75^0 and 90^0 while the span to thickness ratio, α, considered are 5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100. Also, the aspect ratio, β, is taken to be one and half (1.5). Although the solution can be varied for different geometric parameters if the need arises, only the listed boundary conditions were considered. The CSCS plate did not yield any value for in-plane displacement (v), in-plane stress (τ_{xy}) and out-plane stress (τ_{yz}) at the mid-span and edges due to the two opposite edges that are clamped. Hence, the plate was analysed at varying points, x, or y, = 0.2 and x, or y, = 0.5, to obtain the maximum values (see section 3.7).

i. CSCS plate at angle fiber orientation of 0^0

Table 4.6a presents the results obtained and from observation, the values of displacements, ($\overline{w}$, $\overline{v}$), and the stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{yz}}$), decrease as the thickness of the plate decreases while the displacement, ($\overline{u}$), and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xz}}$), increase as the plate thickness decreases. At the minimum span to thickness ratio of, (5), the displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yield values as follows, (0.00266, -0.02646, -0.05007) and (-0.00458, -0.00027, 0.00624, 0.11327, 0.01074) while at the maximum span to thickness ratio of, (100), the displacements and stresses yield the following values, (0.00032, -4.79300, -3.24718) and (-0.00206, -0.00006, 0.00148, 0.12668, 0.00267). The decrease was very visible at the thick and moderately thick plate zone, (α = 5 to 30), but becomes very small at the thin plate zone, (α = 50 to 100). This shows that the displacements and stresses of CSCS plate acts more on thick plate than on thin plate.

ii. CSCS plate at angle fiber orientation of 15^0

From Table 4.6b, the values of displacements ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), decrease as the thickness of the plate decreases while the values of the in-plane stresses ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$) increase as the plate thickness decreases. The decrease was very visible at the thick plate zone, (α = 5 to 10), but becomes very small at the thin plate zone, (α = 50 to 100). At the minimum span to thickness ratio of, (5), the displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yield values as follows, (0.0036, -0.03413, -0.06239) and (-0.06376, -0.00550, 0.03238, 0.15637, 0.01791) while at the maximum span to thickness ratio of, (100), the displacements and stresses yield the following values, (0.00035, -5.22946, -3.53106) and (0.01401, -0.00118, 0.00689, 0.12674, 0.00694). Summarily, it can be stated that for CSCS anisotropic plate at 15^0 angle fiber orientation the displacements and shear stresses decrease as the thickness of the plate decreases while the in-plane stresses increase as the thickness of the plate decreases. This shows that the displacements and stresses of CSCS plate at 15^0 angle fiber orientation acts more on thick plate than thin plate.

iii. CSCS plate at angle fiber orientation of 30^0

From Table 4.6c, the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), decrease as the thickness of the plate decreases while the values of the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), increase as the plate thickness decreases. The decrease and the increase were very visible at the thick plate zone, (α = 5 to 10), but becomes very small at the thin plate zone, (α = 50 to 100). However, the in-plane displacements, ($\overline{u}$, $\overline{v}$), increased at thick plate zone, (α = 5 to 10), and then decreased at the moderate thick plate and thin plate zone, (α = 20 to 100). At the minimum span to thickness ratio of, (5), the displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yield the following values, (0.01296, -0.10818, -0.18543) and (-0.26033, -0.08977, 0.24145, 0.58426, 0.08782) while at the maximum span to thickness ratio of, (100), the displacements and stresses yield the following values, (0.00044, -6.72973, -4.50499) and (-0.02335, -0.00801, 0.02141, 0.12514, 0.02227). This shows that the displacements and stresses of CSCS plate at 15^0 angle fiber orientation acts more on thick plate than thin plate.

Hence, it can be stated here that for CSCS plate at angle fiber orientation of 30^0, the displacements and shear stresses decrease as the thickness of the plate decreases while the in-plane stresses increase as the thickness of the plate decreases.

iv. CSCS plate at angle fiber orientation of 45^0

Table 4.6d show that the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{yz}}$), increase as the plate thickness decreases. The decrease and the increase were very visible at the thick plate zone, (α = 5 to 10), but becomes very small at the thin plate zone, (α = 50 to 100). However, the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), decrease at thick plate zone, (α = 5 to 10), before it start to increase at moderate thick plate and thin plate zone, (α = 20 to 100). Also, the stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), increased at thick plate zone, (α = 5 to 10), before it start to decrease at moderate thick plate and thin plate zone, (α = 20 to 100). At the minimum span to thickness ratio of, (5), the displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yield values as follows, (0.0487, 0.39615, 0.52882) and (0.62017, 0.61987, -0.96480, -2.2093, -0.4303), while at the maximum span to thickness ratio of, (100), the displacements and stresses yielded the following values, (0.00064, -9.79626, -6.48884) and (-0.02571, -0.02561, 0.03979, 0.11516, 0.05591). This shows that the displacements and stresses of CSCS plate at 45^0 angle fiber orientation acts more on thick plate than thin plate.

v. CSCS plate at angle fiber orientation of 60^0

From Table 4.6e, the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{yz}}$), increase as the plate thickness decreases. The decrease and the increase were very visible at the thick plate zone, (α = 5 to 10), but becomes very small at the thin plate zone, (α = 50 to 100). However, the in-plane displacement, ($\overline{v}$), increases at thick plate zone, (α = 5 to 10) before it start to decrease at moderate thick plate and thin plate zone, (α = 20 to 100). Also, the stress, ($\overline{\tau_{zy}}$), decreases at thick plate zone, (α = 5 to 10), then increases at moderate thick plate and thin plate zone, (α = 20 to 100). At the minimum span to thickness ratio of, (5), the displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yield values as follows, (0.01503, -0.19812, -0.11116) and (-0.08533, -0.24566, 0.22803, 0.56847, 0.16414) while at the maximum span to thickness ratio of, (100), the displacements and stresses yield the following values, (0.00095, -14.46300, -9.49385) and (-0.01677, -0.04835, 0.04486, 0.08622, 0.11188). This shows that the displacements and stresses of CSCS plate at 60^0 angle fiber orientation acts more on thick plate than thin plate.

vi. CSCS plate at angle fiber orientation of 75^0

From Table 4.6f, it is observed that the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the stresses ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{yz}}$) increase as the plate thickness decreases. These decrease and increase of stresses and displacements values were very visible at the thick plate zone, (α = 5 to 10), but becomes very small at the thin plate zone, (α = 50 to 100). At the minimum span to thickness ratio of, (5), the displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\sigma_{xx}}$,

$\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yield values as follows, (0.00652, -0.15719, -0.03900) and (-0.00960, -0.10396, 0.05376, 0.14003, 0.07682) while at the maximum span to thickness ratio of, (100), the displacements and stresses yield the following values, (0.00121, -18.63225, -12.16252) and (-0.00405, 0.04557, 0.02326, 0.04481, 0.16735). Summarily, it can be stated that for CSCS anisotropic plate at 75^0 angle fiber orientation the displacements and shear stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the in-plane stresses and out-plane stress ($\overline{\tau_{yz}}$) increase as the thickness of the plate decreases. This shows that the displacements and stresses of CSCS plate at 75^0 angle fiber orientation acts more on thick plate than thin plate.

vii. CSCS plate at angle fiber orientation of 90^0

From Table 4.6g, the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{yz}}$), increase as the plate thickness decreases. These decrease and increase of stresses and displacements values were very visible at the thick plate zone, (α = 5 to 10), but becomes very small at the thin plate zone, (α = 50 to 100). At the minimum span to thickness ratio of, (5), the displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yielded values as follows, (0.00619, -0.18283, -0.03792) and (-0.00960, -0.00129, -0.00464, 0.01473, 0.08240, 0.07235), while at the maximum span to thickness ratio of, (100), the displacements and stresses yielded the following values, (0.00131, -20.06464, -13.7366) and (-0.00038, 0.00381, 0.00609, 0.02510, 0.18835). Summarily, it can be stated that for CSCS anisotropic plate at 90^0 angle fiber orientation the displacements and shear stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the in-plane stresses and out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases. This shows that the displacements and stresses of CSCS plate at 90^0 angle fiber orientation acts more on thick plate than thin plate.

viii. CSCS plate variation of displacements and rotation with angle fibre orientation

The values of CSCS displacements, (w, u, v), for, 0^0, angle fibre orientation, β = 1, α = 5, (0.00266, -0.02646, -0.05007) and, α = 100, (0.00032, -4.79300, -3.24718) were as given. These values at, α = 5 and α = 100, yielded differences, (w = 0.00234, u = 4.76654, v = 3.19711). It also yielded differences of, (w = 0.00325, u = 5.19533, v = 3.46867), at 15^0, and differences of, (w = 0.01252, u = 6.62155, v = 4.31956), at 30^0. The differences obtained at, 45^0, 60^0, 75^0, and 90^0, are as follows; (w = 0.04806, u = 9.40011, v = 5.96002), (w = 0.01408, u = 14.26488, v = 9.38269), (w = 0.00531, u = 18.4751, v = 12.12352) and (w = 0.00488, u = 19.88181, v = 13.03574) respectively. It is observed from the differences that the values of the displacement, (w), for CSCS plate boundary condition increases as the angle fiber orientation increases and changed trend at 60^0, angle fiber orientation and started decreasing up till 90^0, angle fiber orientation as shown above. The in-plane displacements, (u,v), increases as the angle fiber orientation increases throughout the entire angle considered.

4.2.5.6 Numerical values of displacements and stresses for CCCS anisotropic rectangular thick plate

The numerical values of displacements and stresses for CCCS anisotropic rectangular thick plate are tabulated on Table 4.7a, 4.7b, 4.7c, 4.7d, 4.7e, 4.7f and 4.7g. The angle fibre orientation used are as follows; 0^0, 15^0, 30^0, 45^0, 60^0, 75^0 and 90^0 while the span to thickness ratio, α, considered are 5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100. Also, the aspect ratio, β, is taken to be one and half (1.5). The solution can be varied for different geometric parameters if the need arises, only the listed geometric parameters were considered. CCCS plate did not yield any value for in-plane displacement, ($\bar{v}$), in-plane stress, ($\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{yz}}$), when points at mid-span and edges were considered due to the three clamped edges of the plate. Hence, the plate was analysed at varying points, x, or y, = 0.2, and x, or y, = 0.5, to obtain the maximum values (see section 3.7).

i. CCCS plate at angle fiber orientation of 0^0

From Table 4.7a, it is observed that the values of displacements, ($\bar{w}$, $\bar{u}$, $\bar{v}$) and stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{yz}}$), decrease as the thickness of the plate decreases while the values of the stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xz}}$), increase as the plate thickness decreases. At the minimum span to thickness ratio of, (5), the displacements, ($\bar{w}$, $\bar{u}$, $\bar{v}$) and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yield values as follows, (0.00739, -0.09359, -0.14449) and (-0.01618, -0.00082, 0.01907, 0.28550, 0.02688) while at the maximum span to thickness ratio of, (100), the displacements and stresses yield the following values, (0.00159, -24.16039, -16.23061) and (-0.01038, -0.00029, 0.00745, 0.32097, 0.01138). The decrease and increase in the values of displacements and stresses were more at the thick and moderately thick plate zone, (α = 5 to 30), but becomes very small at the thin plate zone, (α = 50 to 100). This shows that the displacements and stresses of CCCS plate acts more on thick plate than thin plate.

ii. CCCS plate at angle fiber orientation of 15^0

From Table 4.7b, the values of displacements, ($\bar{w}$, $\bar{u}$, $\bar{v}$) and stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{yz}}$), decrease as the thickness of the plate decreases while the values of the stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xz}}$), increase as the plate thickness decreases. These decrease and increase of stresses and displacements values were very visible at the thick plate zone, (α = 5 to 10), but becomes very small at the thin plate zone, (α = 50 to 100). At the minimum span to thickness ratio of, (5), the displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yield values as follows, (0.00719, -0.09009, -0.12679) and (-0.14213, -0.01220, 0.07162, 0.27917, 0.03441), while at the maximum span to thickness ratio of, (100), the displacements and stresses yield the following values, (0.00163, -24.89827, -16.68742) and (-0.06650, -0.00562, 0.03271, 0.30758, 0.02888).

iii. CCCS plate at angle fiber orientation of 30^0

From Table 4.7c, the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stress, ($\overline{\tau_{xy}}$), decrease as the thickness of the plate decreases while the values of the stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), increase as the plate thickness decreases. At the minimum span to thickness ratio of, (5), the displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yield values as follows, (0.00682, -0.08919, -0.09305) and (-0.15631, -0.05376, 0.14411, 0.25909, 0.04894), while at the maximum span to thickness ratio of, (100), the displacements and stresses yielded the following values, (0.00179, -27.33189, -18.20908) and (-0.09464, -0.03247, 0.08673, 0.26955, 0.07919). The decrease and increase in the values of displacements and stresses were more at the thick and moderately thick plate zone, (α = 5 to 30), but becomes very small at the thin plate zone, (α = 50 to 100). This shows that the displacement and stresses of CCCS plate acts more on thick plate than thin plate.

iv. CCCS plate at angle fiber orientation of 45^0

Table 4.7d shows that the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{yz}}$), increase as the plate thickness decreases. These decrease and increase of stresses and displacements values were very visible at the thick plate zone, (α = 5 to 10) but becomes very small at the thin plate zone, (α = 50 to 100). At the minimum span to thickness ratio of, (5), the displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yield values as follows, (0.00688, -0.11370, -0.6269) and (-0.10966, -0.10917, 0.16953, 0.22555, 0.06801), while at the maximum span to thickness ratio of, (100), the displacements and stresses yield the following values, (0.00210, -32.05569, -21.20138) and (-0.08405, -0.8375, 0.13011, 0.21170, 0.15790).

v. CCCS plate at angle fiber orientation of 60^0

From Table 4.7e, the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stress, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{yz}}$), increase as the plate thickness decreases. At the minimum span to thickness ratio of, (5), the displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yield values as follows, (0.00848, -0.20064, -0.05253) and (-0.06553, -0.18753, 0.17437, 0.18746, 0.09873), while at the maximum span to thickness ratio of, (100), the displacements and stresses yield the following values, (0.00258, -39.59470, -26.02639) and (-0.04595, -0.13246, 0.12290, 0.13997, 0.25937). The decrease and increase in the values of displacements and stresses were more at the thick and moderately thick plate zone, (α = 5 to 30), but becomes very small at the thin plate zone, (α = 50 to 100). This shows that the displacements and stresses of CCCS plate acts more on thick plate than thin plate.

vi. CCCS plate at angle fiber orientation of 75^0

From Table 4.7f, it is observed that the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{yz}}$), increase as the plate thickness decreases. These decrease and increase of stresses and displacements values were very visible at the thick plate zone, (α = 5 to 10), but becomes very small at the thin plate zone, (α = 50 to 100). At the minimum span to thickness ratio of, (5), the displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yield values as follows, (0.01318, -0.40361, -0.07907) and (-0.02330, -0.25044, 0.12985, 0.15375, 0.15500), while at the maximum span to thickness ratio of, (100), the displacements and stresses yield the following values, (0.00317, -48.59043, -31.81830,) and (-0.01058, -0.11903, 0.06076, 0.06895, 0.36358).

vii. CCCS plate at angle fiber orientation of 90^0

From Table 4.7g, the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stress, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{yz}}$), increase as the plate thickness decreases. At the minimum span to thickness ratio of, (5), the displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$) and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), yielded values as follows, (0.01785, -0.59585, -0.11448) and (-0.00421, -0.01408, 0.04716, 0.13445, 0.20550), while at the maximum span to thickness ratio of, (100), the displacements and stresses yield the following values, (0.00346, -53.18527, -34.78409) and (-0.00101, -0.01015, 0.01618, 0.03581, 0.41320). The decrease and increase in the values of displacements and stresses were more at the thick and moderately thick plate zone, (α = 5 to 30), but becomes very small at the thin plate zone, (α = 50 to 100). This shows that the displacements and stresses of CCCS plate acts more on thick plate than thin plate.

viii. CCCS plate variation of displacements and rotation with angle fibre orientation

The values of CCCS displacements, (w, u, v), for, 0^0, angle fibre orientation, β = 1, α = 5, (0.00739, -0.09359, -0.14449) and, α = 100, (0.00159, -24.16039, -16.23061) were as given. These values at, α = 5 and α = 100, yielded differences, (w = 0.0058, u = 24.0668, v = 16.08612). It also yielded differences of, (w = 0.00556, u = 24.80818, v = 16.56063), at 15^0, and differences of, (w = 0.00503, u = 27.2427, v = 18.11603), at 30^0. The differences obtained at, 45^0, 60^0, 75^0, and 90^0, are as follows; (w = 0.00478, u = 31.91869, v = 21.13869), (w = 0.0059, u = 39.39406, v = 25.97386), (w = 0.01001, u = 48.18682, v = 31.73923) and (w = 0.01439, u = 52.58942, v = 34.66961) respectively. It is observed from the differences that the values of the out-plane displacement, (w) for CCCS plate boundary condition decreases as the angle fiber orientation increases and changed trend at 60^0, angle fiber orientation and started increasing up till 90^0, angle fiber orientation as shown above. The in-plane displacements, (u,v), increases as the angle fiber orientation increases throughout the entire angle considered.

4.2.5.7 Numerical values of displacements and stresses for SSFS anisotropic rectangular thick plate

The numerical values of displacements and stresses for SSFS anisotropic rectangular thick plate were presented on Table 4.8a, 4.8b, 4.8c, 4.8d, 4.8e, 4.8f and 4.8g. The angle fibre orientation used are as follows: 0^0, 15^0, 30^0, 45^0, 60^0, 75^0 and 90^0 while the span to thickness ratio, α, considered are 5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100. Also, the aspect ratio, β, is taken to be one (1). The solution can be varied for different geometric parameters if the need arises, only the listed boundary conditions were considered.

i. SSFS plate at angle fiber orientation of 0^0

Table 4.8a shows that the values of out-plane displacement, ($\overline{w}$), increases as the thickness of the plate decreases while the values of the in-plane displacements, ($\overline{u}$, $\overline{v}$) decrease as the thickness of the plate decreases and becomes more noticeable at the thin plate section, (α = 50 to 100).

The values of the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), increase as the thickness of the plate decreases while the values of the in-plane stress, ($\overline{\tau_{xy}}$) and out-plane stress, ($\overline{\tau_{yz}}$), decrease as the plate thickness decreases vice versa. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, ($\alpha = 5$ to 10), but gradually decrease as the thickness of the plate decreases.

ii. SSFS plate at angle fiber orientation of 15^0

From Table 4.8b, the values of out-plane displacement, ($\bar{w}$), increases as the thickness of the plate decreases while the values of the in-plane displacements, ($\bar{u}$ and $\bar{v}$), decrease as the thickness of the plate decreases and becomes more noticeable at the thin plate section, ($\alpha = 50$ to 100). However, the out-plane displacement has more effect on thick plate, ($\alpha = 5$ to 10), while the in-plane displacements has more effect on thin plate ($\alpha = 50$ to 100).

Also, the values of the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$) and out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases while the values of the in-plane stress, ($\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, ($\alpha = 5$ to 10), but gradually decreases as the thickness of the plate decreases.

iii SSFS plate at angle fiber orientation of 30^0

Table 4.8c shows that the values of out-plane displacement, ($\bar{w}$), increases as the thickness of the plate decreases while the values of the in-plane displacements, ($\bar{u}$, $\bar{v}$) decrease as the thickness of the plate decreases and becomes more noticeable at the thin plate section, ($\alpha = 50$ to 100). However the out-plane displacements has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also the values of the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), and out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases while the values of the in-plane stress, ($\overline{\tau_{xy}}$) and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, ($\alpha = 5$ to 10), but gradually decrease as the thickness of the plate decreases.

iv. SSFS plate at angle fiber orientation of 45^0

From Table 4.8d, it is observed that the values of out-plane displacement, ($\bar{w}$), increases as the thickness of the plate decreases while the values of the in-plane displacements, ($\bar{u}$, $\bar{v}$), decrease as the thickness of the plate decreases and becomes more noticeable at the thin plate section ($\alpha = 50$ to 100). However, the out-plane displacement has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also the values of the in-plane stresses ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$) and out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases while the values of the in-plane stress ($\overline{\tau_{xy}}$) and out-plane stress ($\overline{\tau_{xz}}$) decrease as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section (α = 5 to 10) but gradually decreases as the thickness of the plate decreases.

v. SSFS plate at angle fiber orientation of 60^0

From Table 4.8e, the values of out-plane displacement, ($\overline{w}$), increases as the thickness of the plate decreases while the values of the in-plane displacements ($\bar{u}$, $\bar{v}$) decrease as the thickness of the plate decreases and becomes more noticeable at the thin plate section, (α = 50 to 100). Hence the out-plane displacement has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also the values of the in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$) and out-plane stress, ($\overline{\sigma_{yz}}$), increase as the thickness of the plate decreases while the values of the in-plane stress, ($\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section (α = 5 to 10) but gradually decrease as the thickness of the plate decreases.

vi. SSFS plate at angle fiber orientation of 75^0

Table 4.8f, shows that the values of out-plane displacement, ($\overline{w}$), increases as the thickness of the plate decreases while the values of the in-plane displacement ($\bar{u}$, $\bar{v}$) decrease as the thickness of the plate decreases and becomes more noticeable at the thin plate section, (α = 50 to 100). Hence the out-plane displacement has more effect on thick plate while the in-plane displacement has more effect on thin plate.

Also the values of the in-plane stress, ($\overline{\sigma_{xx}}$) and out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases while the values of the in-plane stress, ($\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$) and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the plate thickness decreases vice versa. This increase or decrease in stresses as the plate thickness decrease are very obvious at the thick plate section (α = 5 to 10) but gradually diminishes as the thickness of the plate decreases.

vii. SSFS plate at angle fiber orientation of 90^0

From Table 4.8g, it is observed that the values of out-plane displacement, ($\overline{w}$), increases as the thickness of the plate decreases while the values of the in-plane displacements, ($\overline{u}$, $\overline{v}$) decrease as the thickness of the plate decreases and becomes more noticeable at the thin plate section, (α = 50 to 100). However the out-plane displacement has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also the values of the in-plane stress, ($\overline{\sigma_{xx}}$) and out-plane stress, ($\overline{\sigma_{yz}}$), increase as the thickness of the plate decreases while the values of the in-plane stress, ($\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$) and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually diminishes as the thickness of the plate decreases.

viii. SSFS plate variation of displacements and rotation with angle fibre orientation

The values of SSFS displacements, (w, u, v), for, 0^0, angle fibre orientation, β = 1, α = 5, (0.01617, -0.028878, -0.24675) and, α = 100, (0.00562, -89.4954, -35.9605) were as given. These values at, α = 5 and α = 100, yielded differences, (w = 0.01055, u = 89.20662, v = 35.71375). It also yielded differences of, (w = 0.00979, u = 92.10681, v = 36.8462), at 15^0, and differences of, (w = 0.00821, u = 103.5248, v = 41.3398), at 30^0. The differences obtained at, 45^0, 60^0, 75^0, and 90^0, are as follows; (w = 0.00689, u = 133.7453, v = 53.3623), (w = 0.00706, u = 214.3279, v = 85.5884), (w = 0.0113, u = 454.9119, v = 181.0783) and (w = 0.01972, u = 817.3961, v = 326.9542) respectively. It is observed from the differences that the values of the displacement, (w), for SSFS plate boundary condition decreases as the angle fiber orientation increases and changed trend at 75^0, angle fiber orientation and started decreasing up till 90^0, angle fiber orientation as shown above. The in-plane displacements, (u,v), increases as the angle fiber orientation increases throughout the entire angle considered.

4.2.5.8 Numerical values of displacements and stresses for CCFC anisotropic rectangular thick plate

The numerical values of displacements and stresses for CCFC anisotropic rectangular thick plate were presented on Table 4.9a, 4.9b, 4.9c, 4.9d, 4.9e, 4.9f and 4.9g. The angle fibre orientation used are as follows; 0^0, 15^0, 30^0, 45^0, 60^0, 75^0 and 90^0 while the span to thickness ratio, α, considered are 5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100. Also, the aspect ratio, β, is taken to be one and half (1.5). Although the solution can be varied for different geometric parameters if the need arises, only the listed boundary conditions were considered. The CCFC plate yielded zero values for in-plane displacement, ($\bar{u}$), and out-plane stress, ($\overline{\tau_{xz}}$), at the mid-span and edges due to the type of support at the edges of the plate. Hence, the plate was analysed at varying points, x, or y, = 0.2 and x, or y, = 0.5, to obtain the maximum values (see section 3.7).

i. CCFC plate at angle fiber orientation of 0^0

From Table 4.9a, it is observed that the values of displacements, ($\bar{w}$, $\bar{u}$, $\bar{v}$), and the in-plane stress, ($\overline{\tau_{xy}}$), decrease as the thickness of the plate decreases while the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), and the out-plane stresses, ($\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), increase as the plate thickness decreases. The decrease and the increase of the displacements and stresses are very obvious at the thick plate zone, (α = 5 to 10), but gradually diminishes towards moderate thick and thin plate zone, (α = 20 to 100). The values obtained for displacements, ($\bar{w}$, $\bar{u}$, $\bar{v}$), and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), at the minimum span to thickness ratio of (5) are, (0.00037, -0.00365, -0.00929) and (-0.00064, -0.00005, 0.00108, 0.01566, 0.00007), while at the maximum span to thickness ratio of (100), it yields, (0.00004, -0.62069, -0.42092) and (-0.00027, -0.00001, 0.00019, 0.01637, 0.00009). The values obtained were progressively increasing or decreasing up till span to thickness ration of (40) and then changed trend and yielded similar or close values from span to thickness ratio of (50) to (100) for each particular stresses and out-plane displacement.

ii. CCFC plate at angle fiber orientation of 15^0

From Table 4.9b, the values of displacements, ($\bar{w}$, $\bar{u}$, $\bar{v}$), and the stress, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), and the out-plane stress, ($\overline{\tau_{yz}}$), increase as the plate thickness decreases. The decrease and the increase of the displacements and stresses have a wider margin between the preceding values at the thick plate zone, (α = 5 to 10), but gradually diminishes towards moderate thick and thin plate zone, (α = 20 to 100). The values obtained for displacements, ($\bar{w}$, $\bar{u}$, $\bar{v}$), and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), at the minimum span to thickness ratio of (5) are, (0.00061, -0.00569, -0.01633) and (-0.01473, -0.00128, 0.00757, 0.02656, -0.0004), while at the maximum span to thickness ratio of (100), it yields, (0.00005, -0.69427, -0.46957) and (-0.00186, -0.00016, 0.00092, 0.01670, 0.00042). The values obtained from span to thickness ratio of (50) to (100) for each particular stresses and out-plane displacement are close to preceding span to thickness ratio. Hence, it can be stated here that for CCFC plate at angle fiber orientation of 15^0, the displacement, ($\bar{w}$, $\bar{u}$, $\bar{v}$), and stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the plate thickness decreases while the stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{yz}}$), increase as the plate thickness decreases.

iii. CCFC plate at angle fiber orientation of 30^0

From Table 4.9c, it is observed that the values of displacements, $(\bar{w}, \bar{u}, \bar{v})$, and the stress, $(\overline{\tau_{xy}}, \overline{\tau_{xz}})$, decrease as the thickness of the plate decreases while the in-plane stresses, $(\overline{\sigma_{xx}}, \overline{\sigma_{yy}})$, and the out-plane stress, $(\overline{\tau_{yz}})$, increase as the plate thickness decreases. However, the out-plane displacement, $(\bar{w})$, and stresses, $(\overline{\tau_{xy}}, \overline{\tau_{xz}})$, increased at the thick plate zone, (α = 5 to 10) and then changed trend and started to decrease at moderate thick and thin plate zone, (α = 20 to 100). Also the in-plane stresses, $(\overline{\sigma_{xx}}, \overline{\sigma_{yy}})$, and the out-plane stress, $(\overline{\tau_{yz}})$, decreased at the thick plate zone, (α = 5 to 10), and then changed trend and started to increase at moderate thick and thin plate zone, (α = 20 to 100). The decrease and the increase of the displacements and stresses have a wider margin between the preceding values at the thick plate zone, (α = 5 to 10), but gradually diminishes towards moderate thick and thin plate zone, (α = 20 to 100). The values obtained for displacements, $(\bar{w}, \bar{u}, \bar{v})$, and stresses, $(\overline{\sigma_{xx}}, \overline{\sigma_{yy}}, \overline{\tau_{xy}}, \overline{\tau_{xz}}, \overline{\tau_{yz}})$, at the minimum span to thickness ratio of (5) are, (-0.0016, 0.01213, 0.04714) and (0.05488, 0.01898, -0.05128, -0.0747, 0.00350), while at the maximum span to thickness ratio of (100), it yielded, (0.00006, -0.97667, -0.65649) and (-0.00340, -0.00117, 0.00311, 0.01774, 0.00150). The values obtained from span to thickness ratio of (50) to (100) for each particular stresses and out-plane displacement are close to preceding span to thickness ratio.

iv. CCFC plate at angle fiber orientation of 45^0

Table 4.9d, shows that the values of displacements, $(\bar{w}, \bar{u}, \bar{v})$, and the stress, $(\overline{\tau_{xy}}, \overline{\tau_{xz}})$, decrease as the thickness of the plate decreases while the in-plane stresses, $(\overline{\sigma_{xx}}, \overline{\sigma_{yy}})$, and the out-plane stress, $(\overline{\tau_{yz}})$, increase as the thickness of the plate decreases. However, the out-plane displacement, $(\bar{w})$, and stresses, $(\overline{\tau_{xy}}, \overline{\tau_{xz}})$, increased at the thick plate zone, (α = 5 to 10), and then changed trend and started to decrease at moderate thick and thin plate zone (α = 20 to 100). Also the in-plane stresses, $(\overline{\sigma_{xx}}, \overline{\sigma_{yy}})$, decreased at the thick plate zone, (α = 5 to 10), and then changed trend and started to increase at moderate thick and thin plate zone, (α = 20 to 100). The decrease and the increase of the displacements and stresses have a wider margin between the preceding values at the thick plate zone, (α = 5 to 10), but gradually diminishes towards moderate thick and thin plate zone, (α = 20 to 100). The values obtained for displacements, $(\bar{w}, \bar{u}, \bar{v})$, and stresses, $(\overline{\sigma_{xx}}, \overline{\sigma_{yy}}, \overline{\tau_{xy}}, \overline{\tau_{xz}}, \overline{\tau_{yz}})$, at the minimum span to thickness ratio of (5) are,(-0.0005, 0.00300, 0.01637) and (0.01418, 0.01423, -0.02221, -0.0266, 0.00152), while at the maximum span to thickness ratio of (100), it yields, (0.00011, -1.74488, -1.16587) and (-0.00340, -0.00460, -0.00458, 0.00712, 0.01954, 0.00364). The values obtained from span to thickness ratio of

(50) to (100) for each particular stresses and out-plane displacement are close to preceding span to thickness ratio.

v. CCFC plate at angle fiber orientation of 60^0

From Table 4.9e, it is observed that the values of out-plane displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and the stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), and the out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases. However, the out-plane displacement, ($\overline{w}$), and stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), increased at the thick plate zone, (α = 5 to 10), and then changed trend and started to decrease at moderate thick and thin plate zone, (α = 20 to 100). Also the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), decreased at the thick plate zone, (α = 5 to 10), and then changed trend and started to increase at moderate thick and thin plate zone, (α = 20 to 100). The decrease and the increase of the displacements and stresses have a wider margin between the preceding values at the thick plate zone, (α = 5 to 10), but gradually diminishes towards moderate thick and thin plate zone, (α = 20 to 100). The values obtained for displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), at the minimum span to thickness ratio of (5) are, (-0.0014, 0.01332, 0.03492) and (0.01529, 0.04652, -0.04118, -0.0603, -0.0005), while at the maximum span to thickness ratio of (100), it yields, (0.00025, -3.86882, -2.57718) and (-0.00452, -0.01303, 0.01209, 0.02145, 0.00694). The values obtained from span to thickness ratio of (50) to (100) for each particular stresses and out-plane displacement are close to preceding span to thickness ratios.

vi. CCFC plate at angle fiber orientation of 75^0

From Table 4.9f, the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and the stress, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), and the out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases. The decrease and the increase of the displacements and stresses have a wider margin between the preceding values at the thick plate zone (α = 5 to 10) but gradually diminishes towards moderate thick and thin plate zone (α = 20 to 100). The values obtained for displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), at the minimum span to thickness ratio of (5) are, (0.00158, -0.03604, -0.02709) and (-0.00336, -0.03805, 0.01938, 0.03719, 0.00808) while at the maximum span to thickness ratio of (100), it yielded, (0.00057, -8.74689, -5.82485) and (-0.00192, -0.02162, 0.01103, 0.01963, 0.00908). The values obtained from span to thickness ratio of (50) to (100) for each particular stresses and out-plane displacement are close to preceding span to thickness ratios.

vii. CCFC plate at angle fiber orientation of 90^0

From Table 4.9g, it is observed that the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and the stress, ($\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the in-plane stress, ($\overline{\sigma_{xx}}$,), and the out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases. However, the out-plane displacement, ($\overline{w}$), and stresses, ($\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), showed a very unique sequence between preceding values starting from moderate thick plate zone, (α = 20). The decrease and the increase of the displacements and stresses have a wider margin between the preceding values at the thick plate zone, (α = 5 to 10) but gradually diminishes towards moderate thick and thin plate zone, (α = 20 to 100). The values obtained for displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), at the minimum span to thickness ratio of (5) are, (0.00119, -0.03494, -0.02001) and (-0.00026, -0.00234, 0.00399, 0.01629, 0.00632) while at the maximum span to thickness ratio of (100), it yields, (0.00082, -12.53882, -8.35247) and (-0.00024, -0.00244, 0.00385, 0.0153, 0.00811). The values obtained from span to thickness ratio of (50) to (100) for each particular stresses and out-plane displacement are close to preceding span to thickness ratios.

viii. CCFC plate variation of displacements and rotation with angle fibre orientation

The values of CCFC displacements, (w, u, v), for, 0^0, angle fibre orientation, β = 1, α = 5, (0.00037, -0.00365, -0.00929) and, α = 100, (0.00004, -0.62069, -0.42092) were as given. These values at, α = 5 and α = 100, yielded differences, (w = 0.00033, u = 0.61704, v = 0.41163). It also yielded differences of, (w = 0.00056, u = 0.68858, v = 0.45324), at 15^0, and differences of, (w = 0.00154, u = 0.96454, v = 0.60935), at 30^0. The differences obtained at, 45^0, 60^0, 75^0, and 90^0, are as follows; (w = 0.00039, u = 1.74188, v = 1.1495), (w = 0.00115, u = 3.8555, v = 2.54226), (w = 0.00101, u = 8.71085, v = 5.79776) and (w = 0.00037, u = 12.50388, v = 8.33246) respectively. It is observed from the differences that the values of the displacement (w), for CCFC plate boundary condition increases as the angle fiber orientation increases and changed trend at 45^0, angle fiber orientation and decreased before changing trend again and increase at 60^0, angle fibre orientation, then started decreasing as shown above. The in-plane displacements, (u,v), increases as the angle fiber orientation increases along the 7 angle fiber orientations considered.

4.2.5.9 Numerical values of displacements and stresses for SCFS anisotropic rectangular thick plate

The numerical values of displacements and stresses SCFS anisotropic rectangular thick plate were presented on Table 4.10a, 4.10b, 4.10c, 4.10d, 4.10e, 4.10f and 4.10g. The angle fibre orientation used are as follows; 0^0, 15^0, 30^0, 45^0, 60^0, 75^0 and 90^0 while the span to thickness ratio, α, considered are 5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100. Also, the aspect ratio, β, is taken to be one (1). The solution can be varied for different boundary conditions if the need arises but only the listed boundary conditions were considered.

i. SCFS plate at angle fiber orientation of 0^0

Table 4.10a shows that the values of out-plane displacement, ($\overline{w}$), increases as the thickness of the plate decreases while the values of the in-plane displacement, ($\overline{u}$ and $\overline{v}$), decrease as the thickness of the plate decreases and becomes more noticeable at the thin plate section, (α = 50 to 100). Also, the values of the in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), and out-plane stresses, ($\overline{\tau_{xz}}$ and $\overline{\tau_{yz}}$), increase as the thickness of the plate decreases while the values of the in-plane stress, ($\overline{\tau_{xy}}$), decreases as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decreases as the thickness of the plate decreases.

ii. SCFS plate at angle fiber orientation of 15^0

From Table 4.10b, the values of out-plane displacement, ($\overline{w}$), and in-plane displacement, ($\overline{v}$), increase as the thickness of the plate decreases while the values of the in-plane displacement, ($\overline{u}$), decreases as the thickness of the plate decreases and becomes more noticeable at the thin plate section, (α = 50 to 100). Hence the out-plane displacement has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also the values of the in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), and out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases while the values of the in-plane stress, ($\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decrease as the thickness of the plate decreases. Hence, the impact from stresses are felt more on thick plate than thin plate.

iii. SCFS plate at angle fiber orientation of 30^0

Table 4.10c shows that the values of out-plane displacement, ($\overline{w}$), and in-plane displacement, ($\overline{v}$), increase as the thickness of the plate decreases while the values of the in-plane displacement, ($\overline{u}$), decreases as the thickness of the plate decreases and becomes more noticeable at the thin plate section, (α = 50 to 100). Hence the out-plane displacement has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also the values of the in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), and out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases while the values of the in-plane stress, ($\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decreases as the thickness of the plate decreases. Hence, the impact from stresses are felt more on thick plate than thin plate.

iv. SCFS plate at angle fiber orientation of 45^0

Table 4.10d shows that the values of out-plane displacement, ($\overline{w}$), and in-plane displacement, ($\overline{v}$), increase as the thickness of the plate decreases while the values of the in-plane displacement, ($\overline{u}$) decreases as the thickness of the plate decreases and becomes more noticeable at the thin plate section, (α = 50 to 100). Hence the out-plane displacement has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also the values of the in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), and out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases while the values of the in-plane stress, ($\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decrease as the thickness of the plate decreases. Hence, the impact from stresses are felt more on thick plate than thin plate.

v. SCFS plate at angle fiber orientation of 60^0

Table 4.10e shows that the values of out-plane displacement, ($\overline{w}$), increases as the thickness of the plate decreases while the values of the in-plane displacements, ($\overline{u}$ and $\overline{v}$), decrease as the thickness of the plate decreases and becomes more noticeable at the thin plate section, (α = 50 to 100). Thus, the out-plane displacement has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also the values of the in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), and out-plane stress, ($\overline{\sigma_{yz}}$), increase as the thickness of the plate decreases while the values of the in-plane stress, ($\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the plate thickness decreases. These increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), for all the stresses except out-plane stress, ($\overline{\tau_{yz}}$), which has more impact on thin plate section, (α = 50 to 100).

vi. SCFS plate at angle fiber orientation of 75^0

From Table 4.10f, it is observed that the values of out-plane displacement, ($\bar{w}$), increases as the thickness of the plate decreases while the values of the in-plane displacements, ($\bar{u}$ and $\bar{v}$), decrease as the thickness of the plate decreases and becomes more noticeable at the thin plate section, (α = 50 to 100). Thus, the out-plane displacement has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also, the values of the in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), and out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases while the values of the in-plane stress, ($\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), for all the stresses except out-plane stress, ($\overline{\tau_{yz}}$), which has more impact on thin plate section, (α = 50 to 100).

vii. SCFS plate at angle fiber orientation of 90^0

Table 4.10g shows that the values of out-plane displacement, ($\bar{w}$), increases as the thickness of the plate decreases while the values of the in-plane displacements, ($\bar{u}$ and $\bar{v}$), decrease as the thickness of the plate decreases and becomes more noticeable at the thin plate section. Thus, the out-plane displacement has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also, the values of the in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), and out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases while the values of the in-plane stress, ($\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the plate thickness decreases. The increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), for all the stresses except out-plane stress, ($\overline{\tau_{yz}}$), which has more impact on thin plate.

viii. SCFS plate variation of displacements and rotation with angle fibre orientation

The values of SCFS displacements, (w, u, v), for, 0^0, angle fibre orientation, β = 1, α = 5, (0.01142, -0.04699, -0.17713) and, α = 100, (0.00229, -11.35974, -14.67358) were as given. These values at, α = 5 and α = 100, yielded differences, (w = 0.00913, u = 11.31275, v = 14.49645). It also yielded differences of, (w = 0.01018, u = 11.48238, v = 14.66497), at 15^0, and differences of, (w = 0.01369, u = 14.02906, v = 17.79807), at 30^0. The differences obtained at, 45^0, 60^0, 75^0, and 90^0, are as follows; (w = 0.01643, u = 21.17089, v = 26.73956), (w = 0.01323, u = 40.11047, v = 51.15031), (w = 0.01158, u = 93.77863, v = 119.94993) and (w = 0.01177, u = 161.24459, v = 206.37409) respectively. It is observed from the differences that the values of the displacement (w), for SCFS plate boundary condition increases as the angle fiber orientation increases and changed trend at 60^0, angle fiber orientation and started decreasing up till 90^0, angle fiber orientation as shown above. The in-plane displacements, (u,v), increases as the angle fiber orientation increases throughout the angle fiber orientation presented in the work.

4.2.5.10 Numerical values of displacements and stresses for CSFS anisotropic rectangular thick plate

The numerical values of displacements and stresses for CSFS anisotropic rectangular thick plate were presented in table 4.11a, 4.11b, 4.11c, 4.11d, 4.11e, 4.11f and 4.11g. The angle fibre orientations used are as follows; 0^0, 15^0, 30^0, 45^0, 60^0, 75^0 and 90^0 while the span to thickness ratio, α, considered are 5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100. Also, the aspect ratio, β, is taken to be one (1). The solution can be varied for different geometric properties if the need arises, only the listed geometric properties were considered.

i. CSFS plate at angle fiber orientation of 0^0

Table 4.11a shows that the values of out-plane displacement, ($\overline{w}$), and in-plane displacement, ($\overline{u}$ and $\overline{v}$), decrease as the thickness of the plate decreases and become more noticeable at the thin plate section, (α = 50 to 100). Thus, out-plane displacement has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also, the values of the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the out-plane stress, ($\overline{\tau_{yz}}$), increases as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are more noticeable at the thick plate section, (α = 5 to 10).

ii. CSFS plate at angle fiber orientation of 15^0

From Table 4.11b, it is observed that the values of out-plane displacement, ($\overline{w}$), and in-plane displacement, ($\overline{u}$ and $\overline{v}$), decrease as the thickness of the plate decreases and become more noticeable at the thin plate section, (α = 50 to 100). Hence the out-plane displacement has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also, the values of the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the out-plane stress, ($\overline{\tau_{yz}}$), increases as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are more noticeable at the thick plate section, (α = 5 to 10).

iii. CSFS plate at angle fiber orientation of 30^0

From Table 4.11c, it is observed that the values of out-plane displacement, ($\overline{w}$), and in-plane displacement, ($\overline{u}$ and $\overline{v}$), decrease as the thickness of the plate decreases and become more noticeable at the thin plate section, (α = 50 to 100). Thus, the out-plane displacement has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also, the values of the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the out-plane stress, ($\overline{\tau_{yz}}$), increases as the plate thickness decreases. In-plane stress, ($\overline{\tau_{xy}}$), increased at the thick and moderately thick plate section and later changed trend and remained the same values at thin plate section, (α = 50 to 100). This increase or decrease in stresses as the plate thickness decreases are more noticeable at the thick plate section.

iv. CSFS plate at angle fiber orientation of 45^0

From Table 4.11d, it is observed that the values of out-plane displacement, ($\overline{w}$), and in-plane displacements, ($\overline{u}$ and $\overline{v}$), decrease as the thickness of the plate decreases and become more noticeable at the thin plate section, (α = 50 to 100). Thus, the out-plane displacement has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also the values of the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$ and $\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the out-plane stress, ($\overline{\tau_{yz}}$), increases as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are more noticeable at the thick plate section, (α = 5 to 10).

v. CSFS plate at angle fiber orientation of 60^0

Table 4.11e shows that the values of out-plane displacement, ($\overline{w}$), and in-plane displacement, ($\overline{u}$ and $\overline{v}$), decrease as the thickness of the plate decreases and become more noticeable at the thin plate section. Thus, the out-plane displacement has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also, the values of the in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the out-plane stress, ($\overline{\tau_{yz}}$), and in-plane stress, ($\overline{\tau_{xy}}$), increase as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are more noticeable at the thick plate section, (α = 5 to 10).

vi. CSFS plate at angle fiber orientation of 75^0

From Table 4.11f, we observed that the values of out-plane displacement, ($\overline{w}$), and in-plane displacements, ($\overline{u}$ and $\overline{v}$), decrease as the thickness of the plate decreases and become more noticeable at the thin plate section, (α = 50 to 100). Thus, out-plane displacement has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also the values of the in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the out-plane stress, ($\overline{\tau_{yz}}$), and in-plane stress, ($\overline{\tau_{xy}}$), increase as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are more noticeable at the thick plate section.

vii. CSFS plate at angle fiber orientation of 90^0

Table 4.11g shows that the values of out-plane displacement, ($\overline{w}$), and in-plane displacements, ($\overline{u}$ and $\overline{v}$), decrease as the thickness of the plate decreases and become more noticeable at the thin plate section. Thus, the out-plane displacement has more effect on thick plate while the in-plane displacements have more effect on thin plate.

Also the values of the in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the out-plane stress, ($\overline{\tau_{yz}}$), and in-plane stress, ($\overline{\tau_{xy}}$), increase as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are more noticeable at the thick plate section, (α = 5 to 10).

viii. CSFS plate variation of displacements and rotation with angle fibre orientation

The values of CSFS displacements, (w, u, v), for, 0^0, angle fibre orientation, β = 1, α = 5, (0.00223, -0.03967, -0.04963) and, α = 100, (0.00079, -12.6480, -7.54799) were as given. These values at, α = 5 and α = 100, yielded differences, (w = 0.00144, u = 12.60833, v = 7.43027). It also yielded differences of, (w = 0.00113, u = 12.18613, v = 7.24293), at 15^0, and differences of, (w = 0.00074, u = 11.84305, v = 7.02667), at 30^0. The differences obtained at, 45^0, 60^0, 75^0, and 90^0, are as follows; (w = 0.00055, u = 13.23054, v = 7.84137), (w = 0.00061, u = 18.94172, v = 11.23218), (w = 0.00127, u = 36.67579, v = 21.76844) and (w = 0.0028, u = 62.2979, v = 36.99584) respectively. It is observed from the differences that the values of the displacement (w) for CSFS plate boundary condition decreases as the angle fiber orientation increases and changed trend at 60^0, angle fiber orientation and started increasing up till 90^0, angle fiber orientation as shown above. While the in-plane displacements (u,v), decreases as the angle fiber orientation increases and changed trend at 45^0, angle fiber orientation and increases as the angle fiber orientation increases.

4.2.5.11 Numerical values of displacements and stresses for CCFS anisotropic rectangular thick plate

The numerical values of displacements and stresses for CCFS anisotropic rectangular thick plate were tabulated on table 4.12a, 4.12b, 4.12c, 4.12d, 4.12e, 4.12f and 4.12g. The angle fibre orientation used are as follows: 0^0, 15^0, 30^0, 45^0, 60^0, 75^0 and 90^0 while the span to thickness ratio, α, considered are 5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100. Also, the aspect ratio, β, is taken to be one (1). The solution can be varied for different geometric properties if the need arises, only the listed geometric properties were considered.

i. CCFS plate at angle fiber orientation of 0^0

Table 4.12a shows that the values of out-plane displacement, ($\overline{w}$), and in-plane displacements, ($\overline{u}$ and $\overline{v}$), decrease as the thickness of the plate decreases. The decrease is more obvious at the thick plate section, (α = 5 to 10). Hence, displacements have more effect on thick plate than on thin plate. Also, the values of the in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), and out-plane stress, ($\overline{\sigma_{yz}}$), decrease as the thickness of the plate decreases while the values of the in-plane stresses, ($\overline{\tau_{xy}}$), out-plane stress, ($\overline{\tau_{xz}}$), increase as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decrease as the thickness of the plate decreases. Hence, the impact from stresses are felt more on thick plate than thin plate.

ii. CCFS plate at angle fiber orientation of 15^0

From Table 4.12b, the values of out-plane displacement, ($\overline{w}$), and in-plane displacements, ($\overline{u}$ and $\overline{v}$), decrease as the thickness of the plate decreases. The decrease is more obvious at the thick plate section, (α = 5 to 10). Hence, displacements have more effect on thick plate than on thin plate. Also the values of the in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), decrease as the thickness of the plate decreases while the values of the in-plane stresses, ($\overline{\tau_{xy}}$), and out-plane stresses, ($\overline{\tau_{xz}}$ *and* $\overline{\tau_{yz}}$), increase as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decrease as the thickness of the plate decreases. Hence, the impact from stresses are felt more on thick plate than thin plate.

iii. CCFS plate at angle fiber orientation of 30^0

Table 4.12c shows that the values of out-plane displacement, ($\bar{w}$), and in-plane displacements, ($\bar{u}$ and $\bar{v}$), decrease as the thickness of the plate decreases. The decrease is more obvious at the thick plate section, (α = 5 to 10). Hence, displacements have more effect on thick plate than on thin plate. Also, the values of the in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the in-plane stresses, ($\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{yz}}$), increase as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decreases as the thickness of the plate decreases. Hence, the impact from stresses are felt more on thick plate than on thin plate.

iv. CCFS plate at angle fiber orientation of 45^0

From Table 4.12d, it is observed that the values of out-plane displacement, ($\bar{w}$), and in-plane displacements, ($\bar{u}$ and $\bar{v}$), decrease as the thickness of the plate decreases. The decrease is more obvious at the thick plate section, (α = 5 to 10). Hence, displacements have more effect on thick plate than on thin plate. Also, the values of the in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the in-plane stress, ($\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{yz}}$), increase as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decreases as the thickness of the plate decreases. Hence, the impact from stresses are felt more on thick plate than on thin plate.

v. CCFS plate at angle fiber orientation of 60^0

Table 4.12e shows that the values of out-plane displacement, ($\bar{w}$), and in-plane displacements, ($\bar{u}$ and $\bar{v}$), decrease as the thickness of the plate decreases. The decrease is more obvious at the thick plate section, (α = 5 to 10). Hence, displacements have more effect on thick plate than on thin plate. Also, the values of the in-plane stresses, ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the in-plane stress, ($\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{yz}}$), increase as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decreases as the thickness of the plate decreases. Hence, the impact from stresses are felt more on thick plate than on thin plate.

vi. CCFS plate at angle fiber orientation of 75^0

From Table 4.12f, it is observed that the values of out-plane displacement, ($\bar{w}$), and in-plane displacements, ($\bar{u}$ and $\bar{v}$), decrease as the thickness of the plate decreases. The decrease is more obvious at the thick plate section, (α = 5 to 10). Hence, displacements have more effect on thick plate than on thin plate. Also, the values of the in-plane stress, ($\overline{\sigma_{xx}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the in-plane stresses, ($\overline{\sigma_{yy}}$ *and* $\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{yz}}$), increase as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decrease as the thickness of the plate decreases. Hence, the impact from stresses are felt more on thick plate than thin plate.

vi CCFS plate at angle fiber orientation of 90^0

Table 4.12g shows that the values of out-plane displacement, ($\overline{w}$), and in-plane displacements, ($\overline{u}$ and $\overline{v}$), decrease as the thickness of the plate decreases. The decrease is more obvious at the thick plate section, (α = 5 to 10). Hence, displacements have more effect on thick plate than on thin plate. Also, the values of the in-plane stress, ($\overline{\sigma_{xx}}$), and out-plane stress, ($\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the values of the in-plane stresses, ($\overline{\sigma_{yy}}$ *and* $\overline{\tau_{xy}}$), and out-plane stress, ($\overline{\tau_{yz}}$), increase as the plate thickness decreases. This increase or decrease in stresses as the plate thickness decreases are very obvious at the thick plate section, (α = 5 to 10), but gradually decrease as the thickness of the plate decreases. Hence, the impact from stresses are felt more on thick plate than thin plate.

viii. CCFS plate variation of displacements and rotation with angle fibre orientation

The values of CCFS displacements, (w, u, v), for, 0^0, angle fibre orientation, β = 1, α = 5, (0.00159, -0.00652, -0.03598) and, α = 100, (0.00033, -1.62399, -3.11555) were as given. These values at, α = 5 and α = 100, yielded differences, (w = 0.00126, u = 1.61747, v = 3.07957). It also yielded differences of, (w = 0.0012, u = 1.51135, v = 2.8695), at 15^0, and differences of, (w = 0.00117, u = 1.65305, v = 3.12225), at 30^0. The differences obtained at, 45^0, 60^0, 75^0, and 90^0, are as follows; (w = 0.00106, u = 2.21085, v = 4.17244), (w = 0.00091, u = 3.79294, v = 7.18502), (w = 0.00114, u = 8.4062, v = 15.96096) and (w = 0.00179, u = 14.61303, v = 27.76374) respectively. It is observed from the differences that the values of the displacement (w) for CCFS plate boundary condition decreases as the angle fiber orientation increases and changed trend at 75^0, angle fiber orientation and started increasing up till 90^0, angle fiber orientation as shown above. While the in-plane displacements (u,v), increases as the angle fiber orientation increases from 0^0, to 90^0, angle fiber orientation.

4.2.5.12 Numerical values of displacements and stresses for SCFC anisotropic rectangular thick plate

The numerical values of displacements and stresses for SCFC anisotropic rectangular thick plate were presented on table 4.13a, 4.13b, 4.13c, 4.13d, 4.13e, 4.13f and 4.13g. The angle fibre orientations used are as follows: 0^0, 15^0, 30^0, 45^0, 60^0, 75^0 and 90^0 while the span to thickness ratio, α, considered are 5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100. Also, the aspect ratio, β, is taken to be one and half (1.5). Although the solution can be varied for different geometric parameters if the need arises, only the listed geometric parameters were considered. The SCFC plate yielded zero for in-plane displacement ($\bar{u}$) and out-plane stress ($\overline{\tau_{xz}}$) due to the two clamped edges which do not rotate, deflect or exert moments when analysed at the mid-span points on the plate. However, the plate was analysed at various points, x or y = 0.2 and x or y = 0.5, to obtain the maximum value for displacements and stresses (see section 3.7).

i. SCFC plate at angle fiber orientation of 0^0

From Table 4.13a, it is observed that the values of displacements, ($\bar{w}$, $\bar{u}$, $\bar{v}$), and the in-plane stress, ($\overline{\tau_{xy}}$), decrease as the thickness of the plate decreases while the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), and the out-plane stresses, ($\overline{\tau_{yz}}$, $\overline{\tau_{xz}}$), increase as the thickness of the plate decreases. However, the out-plane displacement, ($\bar{w}$), and stresses, ($\overline{\sigma_{yy}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), showed a very unique sequence between preceding values starting from moderate thick plate zone, (α = 20 to 40), the increase or decrease between two successive preceding values, becomes very small and even diminishes to infinitesimal difference at the thin plate zone (α = 50 to 100). The decrease or the increase of the displacements and stresses have a wider margin between the preceding values at the thick plate zone, (α = 5 to 10), but gradually diminishes towards moderate thick and thin plate zone, (α = 20 to 100). The values obtained for displacements, ($\bar{w}$, $\bar{u}$, $\bar{v}$), and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), at the minimum span to thickness ratio of (5) are, (0.00020, -0.00257, -0.00509) and (-0.00045, -0.00003, 0.00063, 0.00786, 0.00007) while at the maximum span to thickness ratio of (100), it yield, (0.00004, -0.61655, -0.41451) and (-0.00026, -0.00001 -0.00019, 0.00816, 0.00009).

ii. SCFC plate at angle fiber orientation of 15^0

From Table 4.13b, the values of displacements, ($\bar{w}$, $\bar{u}$, $\bar{v}$), and the stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), and the out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases. However, the out-plane displacement, ($\bar{w}$), and stresses, ($\overline{\sigma_{yy}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), showed a very unique sequence between preceding values starting from thin plate zone, (α = 50 to 100). The increase or decrease between two successive preceding values, becomes very small and even in some cases diminishes to infinitesimal difference. Also, the decrease or the increase of the displacements and stresses have a wider margin between the preceding values at the thick plate zone, (α = 5 to 10), but gradually diminishes towards moderate thick and thin plate zone, (α = 20 to 100). The values obtained for displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), at the minimum span to thickness ratio of (5) are, (0.00023, -0.00267, -0.00526) and (-0.00525, -0.00045, 0.00267, 0.00912, 0.00034) while at the maximum span to thickness ratio of (100), it yield, (0.00004, -0.62258, -0.41698) and (-0.00166, -0.00014, 0.00082, 0.00803, 0.00098).

iii. SCFC plate at angle fiber orientation of 30^0

From Table 4.13c, it is observed that the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and the stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), and the out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases. However, the out-plane displacement, ($\overline{w}$), and stresses, ($\overline{\sigma_{yy}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), showed a very unique sequence between preceding values starting from thin plate zone, (α = 50 to 100). The increase or decrease between two successive preceding values, becomes very small and even in some cases diminishes to infinitesimal difference. Also, the decrease or the increase of the displacements and stresses have a wider margin between the preceding values at the thick plate zone, (α = 5 to 10), but gradually diminishes towards moderate thick and thin plate zone (α = 30 to 100). The values obtained for displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), at the minimum span to thickness ratio of (5) are, (0.00034, -0.00361, -0.00858) and (-0.01101, -0.00380, 0.01025, 0.01429, 0.00011) while at the maximum span to thickness ratio of (100), it yield, (0.00005, -0.77304, -0.51522) and (-0.00268, -0.00092, 0.00245, 0.00801, 0.00222).

iv. SCFC plate at angle fiber orientation of 45^0

Table 4.13d, shows that the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and the stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), and the out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases. However, the out-plane displacement, ($\overline{w}$), and stresses, ($\overline{\sigma_{yy}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), showed a very unique sequence between preceding values starting from thin plate zone, (α = 50 to 100). The increase or decrease between two successive preceding values, becomes very small and even in some cases diminishes to infinitesimal difference. Also, the decrease or the increase of the displacements and stresses have a wider margin between the preceding values at the thick plate zone, (α = 5 to 10), but gradually diminishes towards moderate thick and thin plate zone (α = 30 to 100). The values obtained for displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), at the minimum span to thickness ratio of (5) are, (0.00049, -0.00553, -0.01204) and (-0.01223, -0.01225, 0.01909, 0.02007, 0.00034) while at the maximum span to thickness ratio of (100), it yield, (0.00008, -1.20523, -0.80088) and (-0.00317, -0.00316, 0.00490, 0.00805, 0.00371).

v. SCFC plate at angle fiber orientation of 60^0

From Table 4.13e, it is observed that the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and the stresses, ($\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$), and the out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases. However, the out-plane displacement, ($\overline{w}$), and stresses, ($\overline{\sigma_{yy}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), showed a very unique sequence between preceding values starting from thin plate zone, (α = 50 to 100). The increase or decrease between two successive preceding values, becomes very small and even in some cases diminishes to infinitesimal difference. Also, the decrease or the increase of the displacements and stresses have a wider margin between the preceding values at the thick plate zone, (α = 5 to 10), but gradually diminishes towards moderate thick and thin plate zone, (α = 30 to 100). The values obtained for displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), at the minimum span to thickness ratio of (5) are, (0.00048, -0.00892, -0.00853) and (-0.0507, -0.01466, 0.01359, 0.01429, 0.00226) while at the maximum span to thickness ratio of (100), it yield, (0.00016, -2.42202, -1.60938) and (-0.00283, -0.00815, 0.00756, 0.00805, 0.00533).

vi. SCFC plate at angle fiber orientation of 75^0

From Table 4.13f, the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and the stresses, ($\overline{\sigma_{yy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\tau_{xy}}$), and the out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases. However, the out-plane displacement, ($\overline{w}$), and stresses, ($\overline{\sigma_{yy}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), showed a very unique sequence between preceding values starting from thin plate zone, (α = 50 to 100). The increase or decrease between two successive preceding values, becomes very small and even in some cases diminishes to infinitesimal difference. Also, the decrease or the increase of the displacements and stresses have a wider margin between the preceding values at the thick plate zone, (α = 5 to 10), but gradually diminishes towards moderate thick and thin plate zone (α = 30 to 100). The values obtained for displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), at the minimum span to thickness ratio of (5) are, (0.00063, -0.01819, -0.00923) and (-0.00141, -0.01572, 0.00805, 0.00898, 0.00413) while at the maximum span to thickness ratio of (100), it yield, (0.00039, -5.99434, -3.98867) and (-0.00132, -0.01481, 0.00756, 0.00753, 0.00654). Note that for in-plane stress, $\overline{\sigma_{xx}}$, the values increased from -0.00141 to -0.00131 and maintained same value till span to thickness ratio of (80) before it decreased to -0.00132 while in-plane stress, $\overline{\sigma_{yy}}$, increased from -

0.01572 to -0.01467 and started to decrease. Hence these increase and decrease of displacements and stresses can be explained from the principles of anisotropy which implies different properties in different direction.

vii. SCFC plate at angle fiber orientation of 90^0

From Table 4.13g, it is observed that the values of displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and the stresses, ($\overline{\sigma_{yy}}$, $\overline{\tau_{xz}}$), decrease as the thickness of the plate decreases while the in-plane stresses, ($\overline{\sigma_{xx}}$, $\overline{\tau_{xy}}$), and the out-plane stress, ($\overline{\tau_{yz}}$), increase as the thickness of the plate decreases. However, the out-plane displacement, ($\overline{w}$), and stresses, ($\overline{\sigma_{yy}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), showed a very unique sequence between preceding values starting from thin plate zone, (α = 50 to 100). The increase or decrease between two successive preceding values, becomes very small and even in some cases diminishes to infinitesimal difference. Also, the decrease or the increase of the displacements and stresses have a wider margin between the preceding values at the thick plate zone, (α = 5 to 10) but gradually diminishes towards moderate thick and thin plate zone (α = 30 to 100). The values obtained for displacements, ($\overline{w}$, $\overline{u}$, $\overline{v}$), and stresses, ($\overline{\sigma_{xx}}$, $\overline{\sigma_{yy}}$, $\overline{\tau_{xy}}$, $\overline{\tau_{xz}}$, $\overline{\tau_{yz}}$), at the minimum span to thickness ratio of (5) are, (0.00087, -0.02882, -0.01440) and (-0.00021, -0.00169, 0.00310, 0.00688, 0.00477), while at the maximum span to thickness ratio of (100), it yield, (0.00068, -10.41331, -6.93399) and (-0.00020, -0.00202, 0.00320, 0.00649, 0.00666).

viii. SCFC plate variation of displacements and rotation with angle fibre orientation

The values of SCFC displacements, (w, u, v), for, 0^0, angle fibre orientation, β = 1, α = 5, (0.00020, -0.00257, -0.00509) and, α = 100, (0.00004, -0.61655, -0.41451) were as given. These values at, α = 5 and α = 100, yielded differences, (w = 0.00016, u = 0.61398, v = 0.40942). It also yielded differences of, (w = 0.00019, u = 0.61991, v = 0.41172), at 15^0, and differences of, (w = 0.00029, u = 0.76943, v = 0.50664), at 30^0. The differences obtained at, 45^0, 60^0, 75^0, and 90^0, are as follows; (w = 0.00041, u = 1.1997, v = 0.78884), (w = 0.00032, u = 2.4131, v = 1.60085), (w = 0.00024, u = 5.97615, v = 3.97944) and (w = 0.00019, u = 10.38449, v = 6.91959) respectively. It is observed from the differences that the values of the displacement (w) for SCFC plate boundary condition increases as the angle fiber orientation increases and changed trend at 60^0, angle fiber orientation and started decreasing up till 90^0, angle fiber orientation as shown above. While the in-plane displacements (u,v) kept increasing from 0^0, angle fiber orientation till 90^0, angle fiber orientation as shown.

4.3 Numerical problems comparisons

In this section, the present study results were compared with the existing literature results obtained by some other scholars by calculating the percentage difference between the present study and the existing literature results by the scholar.

The percentage difference is calculated as follows:

% difference = $\left(\frac{\text{present study value} - \text{previo} \quad \text{author value}}{\text{present study value}}\right) \text{X } 100\%$

Table 4.14 shows a comparison of present study results with that of Atashipour *et al.* (2017).The values of out displacement ($\overline{w}$), from present study were compared with that of Atashipour *et al.* (2017) at aspect ratio of one (1) as shown:

Table 4.14: Comparison of results of non-dimensional deflection, w, from present study with that of Atashipour *et al*.(2017) for rectangular anisotropic plate at 0^0 angle fiber orientation. And aspect ratio of 1 (b/a = 1)

a/t	Author	$\overline{w}$
10	Atashipour et.al.(2017)	0.9520
	Present study	1.0051
	%difference	**5.28%**
20	Atashipour et.al.(2017)	0.7262
	Present study	0.7749
	%difference	**6.28%**
100	Atashipour et.al.(2017)	0.6528
	Present study	0.6981
	%difference	**6.49%**

From Table 4.14, it is observed that, present study deflections (w), have considerable similarity with the deflections obtained by Atashipour *et al*. (2017) in their single layer orthotropic square plate solutions with percentage differences of 5.28%, 6.28% and 6.49% at span to thickness ratios (a/t) of 10, 20 and 100 and aspect ratio of, 1, respectively. The following factors may have contributed to the mild differences between the present study results and that of Atashipour *et al*. (2017):

i. Atashipour *et al*. applied Levy type solution in Fourier differential quadrature while present study used Ritz energy method through exact approach.

ii. Atashipour *et al*. employed modification factor of 5/6 while present study does not require modification factor.

iii. Atashipour *et al*. adopted first order shear deformation theory while present study adopted third order shear deformation theory.

iv. Atashipour et al. employed assumed displacement functions while present study used exact displacement functions.

Table 4.15 show a comparison of present study non-dimensional out-plane displacement ($\overline{w}$) and in-plane stresses ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$) of simply supported orthotropic rectangular plate under uniformly distributed transverse load with that of Shimpi and Patel (2006). The plate aspect ratio a/b = 0.5 i.e. b/a = 2 and thickness to span ratio is t/a = 0.1 i.e a/t = 10 and all other conversions were explained in Table 3.1. The boundary conditions are as stated in section 3.6.

Table 4.15: Comparison of present study non-dimensional out-plane displacement ($\overline{w}$) and in-plane stresses ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$) of simply supported orthotropic rectangular plate under uniformly distributed transverse load with that of Shimpi and Patel (2006)

Plate dimensional parameters		$\overline{w}$, at x = a/2, y = b/2, z = t/2		
		Present study	Shimpi & Patel (2006)	% difference
b/a	a/t			
2.0	20.0	22034	21542	2.22%
	10.0	1451.90	1408.5	2.98%
	7.14286	402.76	387.23	3.86%
1.0	20.0	10,382	10443	0.59%
	10.0	678.57	688.57	1.47%
	7.14286	186.05	191.07	2.70%
0.5	20.0	2054.06	2048.7	0.26%
	10.0	139.46	139.08	0.27%
	7.14286	39.86	39.79	0.18%
$\overline{\sigma_{xx}}$, at x = a/2, y = b/2, z = t/2				
2.0	20.0	262.05	262.67	0.24%
	10.0	65.89	65.975	0.13%
	7.14286	33.863	33.862	0.003%
1.0	20.0	143.425	144.31	0.62%
	10.0	35.59	36.021	1.20%
	7.14286	18.002	18.346	1.91%
$\overline{\sigma_{yy}}$, at x = a/2, y = b/2, z = t/2				
1.0	20.0	88.24	87.08	1.31%
	10.0	21.997	22.21	0.97%
	7.14286	11.178	11.615	3.91%

Nondimensional out-plane displacement ($\overline{w}$) and in-plane stresses ($\overline{\sigma_{xx}}$ and $\overline{\sigma_{yy}}$) of simply supported orthotropic rectangular plate under uniformly distributed transverse load were analyzed through exact approach by applying Ritz energy method using polynomial shear deformation functions. The results were presented in Table 4.15. The table also present results obtained by Shimpi and Patel (2006) using refined plate theory. This refined plate theory results by Shimpi and Patel (2006) were used as basis for comparison of the results obtained in the present study.

The present study exact approach results for out-plane displacement converged well with the results obtained by Shimpi and Patel (2006) with maximum percentage difference being 3.86% for rectangular plate of width/length ratio (b/a = 2), span/thickness ratios (a/t = 7.14286). The minimum percentage difference (0.18%) occurred in the rectangular plate of width/length ratio (b/a = 0.5), span/thickness ratios (a/t = 7.14286). The average percentage difference for the three plates out-plane displacements with three span to thickness ratios each is 1.614%. This serves as a complimentary result to the earlier submission that the obtained orthotropic thick plate out-plane displacement shows good accuracy with that of Shimpi and patel (2006). From Table 4.15, it can be stated that the lesser the aspect ratio the better the out-plane displacement results.

Table 4.15 also shows the comparison of present study results with that of Shimpi and Patel (2006) for non-dimensional in-plane stress ($\overline{\sigma_{xx}}$) of simply-supported orthotropic rectangular plate under uniformly distributed transverse load. The results shows high level of convergence with very low percentage difference for rectangular plate with aspect ratio 2 (b/a = 2) and span to thickness ratios (a/t = 20, 10 and 7.14286). The percentage differences obtained for these aspect ratio and span to thickness ratios are; 0.24%, 0.13% and 0.003%. Square plate also showed high level of convergence with low percentage differences of 0.62, 1.20% and 1.91% for span to thickness ratios (a/t = 20, 10 and 7.14286). From the result of Table 4.15, it is observed that for in-plane stress ($\overline{\sigma_{xx}}$), the higher the aspect ratio (b/a) the better the results.

Presented on Table 4.15 is the values of non-dimensional in-plane stress ($\overline{\sigma_{yy}}$) of simply-supported orthotropic rectangular plate under uniformly distributed transverse load as obtained by present study and Shimpi and Patel (2006). The present study results were compared with the results obtained by Shimpi and Patel (2006) and it shows lower percentage differences for the square plate at a/t = 20, 10 and 7.14286 with percentage differences of 1.32%, 0.97% and 3.91%. It is observed from Table 4.15 that, the present study results converges very well with those from Shimpi and Patel when solving in-plane stress ($\overline{\sigma_{yy}}$) for square plate.

Table 4.16 shows a comparison of present study non-dimensional out-plane stress ($\overline{\tau_{xz}}$) of simply supported orthotropic rectangular plate under uniformly distributed transverse load with those from Srinivas et al. (1970), Reddy (1984), Reissner (1945) and Shimpi and Patel (2006).The span (a) to span (b) ratio a/b = 0.5 i.e. b/a = 2 and thickness to span ratio t/a = 0.1 i.e a/t = 10 and all other conversions were explained in Table 3.1. The boundary conditions are as stated in section 3.6.

Table 4.16: Comparison of present study non-dimensional out-plane stress ($\overline{\tau_{xz}}$) of simply-supported orthotropic rectangular plate under uniformly distributed transverse load with those from Srinivas (1970), Reddy (1984), Reissner (1945) and Shimpi and Patel (2006)

Plate dimensional parameters		$\overline{\tau_{xz}}$, at x = a/2, y = b/2, z = t/2		
		Present study	Srinivas et al. (1970)	% difference
b/a	a/t			
2.0	20.0	13.635	14.048	3.03%
	10.0	6.8082	6.9266	1.74%
	7.14286	4.8544	4.8782	0.49%
Plate dimensional parameters		$\overline{\tau_{xz}}$, at x = a/2, y = b/2, z = t/2		
		Present study	Reddy (1984)	% difference
b/a	a/t			
2.0	20.0	13.635	13.98	2.53%
	10.0	6.8082	6.958	2.20%
	7.14286	4.8544	4.944	1.85%
Plate dimensional parameters		$\overline{\tau_{xz}}$, at x = a/2, y = b/2, z = t/2		
		Present study	Reissner (1945)	% difference
b/a	a/t			
2.0	20.0	13.635	14.114	3.51%
	10.0	6.8082	7.0611	3.71%
	7.14286	4.8544	5.0445	3.92%
Plate dimensional parameters		$\overline{\tau_{xz}}$, at x = a/2, y = b/2, z = t/2		
		Present study	Shimpi & Patel (2006)	% difference
b/a	a/t			
2.0	20.0	13.635	14.03	2.89%
	10.0	6.8082	6.78	0.41%
	7.14286	4.8544	4.70	3.18%

Table 4.16 shows the results comparison for out-plane stress ($\overline{\tau_{xz}}$) of simply-supported orthotropic rectangular plate under uniformly distributed transverse load as obtained by various authors with various theories. Srinivas et al. (1970) used exact theory, Reddy (1984) used higher order shear deformation plate theory, Reissner (1945) used first order shear deformation plate theory while Shimpi and Patel (2006) used refined plate theory. It is interesting to note that all the methods presented in Table 4.16 with exception to present study solution are either moments or stress based approach or both. Also the shear deformation function they applied were different from the shear deformation function of the present study. Their shear deformation functions are stated herein: Srinivas et al. (1970) and Shimpi and

Patel (2006) used $f(z) = \left[\frac{1}{4}\left(\frac{z}{t}\right) - \frac{5}{3}\left(\frac{z}{t}\right)^3\right]$, Reddy (1984) applied $f_1(z) = -C_0 z - C_3 z^3$ and $f_2(z) = -C_1 z - C_3 z^3$, Reissner (1945) used $f(z) = \frac{z}{2}\left[\frac{h^2}{4} - \frac{z^2}{3}\right]$ while present study used $f(z) = z\left(1 - \frac{4}{3}\left[\frac{z}{t}\right]^2\right)$ as shear deformation function. All the solutions yielded close values for stress $\overline{\tau_{xz}}$ even with different shear deformation functions. The work by Srinivas et al. presented the lowest percentage differences when compared with the present study with percentage differences of, 3.03%, 1.74% and 0.49%, (b/a =2) for a/t = 20, 10 and 7.14286 respectively while the solution from Reissner had highest percentage difference on comparing with the present study with differences of 3.51%, 3.71% and 3.92% for the same respective geometric properties. However, other solutions gave values that are still below 3.2% percentage difference which also is a prove of good agreement between them and present study. Reddy percentage differences with present study are 2.53%, 2.20% and 1.85% while Shimpi and Patel results yielded 2.89%, 0.41% and 3.18% respectively. The rectangular plate considered has the following geometric parameters; b/a = 2, a/t = 20, 10 and 7.14286 for all the authors considered on Table 4.16.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The study presents a solution for the analysis of thick rectangular anisotropic plates based on third order shear deformation theory and assumptions. Ritz energy method was employed for the analysis. The solution derived the general orthogonal polynomial displacement functions for a rectangular plate from the governing equation of equilibrium and compatibility equations of a rectangular thick anisotropic plate based on third order shear deformation theory. The shear deformation function used was determined from the first principle. Deflection at the center of the anisotropic rectangular plate was determined for various angles fiber orientation (0^0, 15^0, 30^0, 45^0, 60^0, 75^0 and 90^0), various span to thickness ratios, α (5, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100) and for all the twelve boundary conditions illustrated in figure 1.4, namely: SSSS, CCCC, CCSS, CSCS, CCCS, CSSS, SSFS, CCFC, CSFS, SCFS, SCFC and CCFS. In-plane displacements (u and v), in-plane stresses (σ_x, σ_y and τ_{xy}) and out-plane stresses (τ_{xz} and τ_{yz}) were also determined for the same angles of orientation of fibers, span-depth-ratios and boundary conditions as applied to central deflection. Finally, a functional excel worksheet program was developed for easy analysis of thick anisotropic plates.

The total potential energy functional developed for the rectangular thick anisotropic plate using third order shear deformation theory, the formulated governing equation of equilibrium and the compatibility equations of anisotropic plate, the stiffness coefficients, the orthogonal polynomial shear deformation and the exact displacement functions developed in this work can be used to provide satisfactory solution to anisotropic thick rectangular plate problems.

5.2 RECOMMENDATIONS

This research work used third order shear deformation theory to analyze thick anisotropic rectangular plate through exact approach with twelve boundary conditions. Thus; it is recommended that:

i. The method shall be used when analyzing thick anisotropic rectangular plate due to it suitability and versatility.

ii. Further studies shall use exact approach in third order shear deformation theory in solving other related anisotropic plate problems like thin laminated anisotropic plate, thin layered anisotropic plate and laminated functionally graded anisotropic plate.

iii. Further studies shall use exact approach in third order shear deformation theory in other methods than the Ritz energy method, such as in the Galerkin method, the Kantorovich method, the Trefftz method and the method of least squares.

iv. Further studies shall use exact solution in third order shear deformation theory to analyze thick anisotropic non-rectangular plate problems.

v. Further studies shall use exact approach in third order shear deformation theory to solve thick anisotropic plate with different laminars.

5.3 CONTRIBUTIONS TO KNOWLEDGE

This research work, "Analysis of thick anisotropic plate through exact approach using third order shear deformation theory" has made the following contribution to knowledge:

i. The exact displacement functions derived from the total potential energy functional of thick anisotropic plate using third order polynomial shear deformation can be easily employed to solve anisotropic thick rectangular plate. This has been very difficult using trigonometric shape function.

ii. The solution developed the following displacement equations (Equations 4.5, 4.6 and 4.7) for easy calculation of displacement values.

a. $$w\frac{E_0 t^3}{qa^4} = 12\left[1-\mu_{xy}\mu_{yx}\right]\left(\frac{k_8}{k_T}\right)h = \overline{w} \qquad 4.5$$

b. $$u\frac{E_0}{qa}.\left(\frac{t}{a}\right)^2 = 12\left[1-\mu_{xy}\mu_{yx}\right]\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = \bar{u} \qquad 4.6$$

c. $$v\frac{E_0}{qa}.\left(\frac{t}{a}\right)^2 = 12\left[1-\mu_{xy}\mu_{yx}\right]\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = \bar{v} \qquad 4.7$$

iii. The solution developed the following stress equations (Equations 4.8, 4.9, 4.10, 4.11 and 4.12) which can easily be used to calculate the numerical values for stresses.

a. $$\frac{\sigma_R}{q}.\left(\frac{t}{a}\right)^2 = 12S\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = \overline{\sigma}_R \qquad 4.8$$

b. $$\frac{\sigma_Q}{q}\left(\frac{t}{a}\right)^2 = 12S\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = \overline{\sigma}_Q \qquad 4.9$$

c. $\frac{\tau_{RQ}}{q}\left(\frac{t}{a}\right)^2 = 12S.\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \right.$

$\left.\frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = \bar{\tau}_{RQ}$ 4.10

d. $\frac{\tau_{RS}}{q}\left(\frac{t}{a}\right) = 12\left(\frac{a}{t}\right)^2 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = \bar{\tau}_{RS}$ 4.11

e. $\frac{\tau_{QS}}{q}\left(\frac{t}{a}\right) = 12\left(\frac{a}{t}\right)^2 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = \bar{\tau}_{QS}$ 4.12

iv. This method of orthogonal polynomial displacement functions through exact approach contributes in addressing the inadequacy of literature in this field.

REFERENCES

Abedi, M., Jafari-Talookolaei, R.A., and Valvo, P.S. (2016). A new solution method for free vibration analysis of rectangular laminated composite plates with general stacking sequences and edge restraints. *Journal of Computers and Structures, 175*(1)*,* 144 – 156. https://doi.org/10.1016/j.compstruc.2016.07.007

Ahmed, J. K., Agarwal, V. C., Pal. P., and Srivastav, V. (2013). Static and dynamic analysis of composite laminated plate. *International Journal of Innovative Technology and Exploring Engineering, 3*(6), 56-60. https://doi.org/citeseerx.ist.psu.edu

Akavci, S. S. (2007). The first order shear deformation theory for symmetrically laminated composite plates on elastic foundation. *The Arabian Journal for Science and Engineering, 32*(2), 341-348. https://www.researchgate.net/publication/288690011

Amabili, M. (2008). *Nonlinear Vibrations and Stability of Shells and Plates*. Cambridge University Press: New York, USA.

Ambartsumian, S. A. (1960). On the theory of bending of anisotropic plates and shallow shells. *Journal of Applied Mathematics and Mechanics, 24*(2), 350 -360. https://doi.org/10.1016/0021-8928(60)90052-6

Ashton, J. E., and Waddoups, M. E. (1969). Analysis of anisotropic plates. *Journal of Composite Materials, 3*(1), 148 – 165. https://doi.org/10.1177/002199836900300111

Atashipour, S.R., Girhammar, U.A., and Al-Emrani, M. (2017). Exact Lévy-type solutions for bending of thick laminated orthotropic plates based on 3-D elasticity and shear deformation theories. *Journal of Composite Structures, 163*(5), 129 – 151. https://doi.org/10.1016/j.compstruct.2016.12.026

Auricchio, F., and Sacco, E. (2003). Refined first-order shear deformation theory models for *Composite laminates. Journal of Applied Mechanics, 70*(3), 381 – 391. https://doi.org/10.1115/1.1572901

Avalos, D. R., and Larrondo, H. (1995). Transverse vibrations and buckling of circular plates of discontinuously vary thickness subject to and in-plane state of hydrostatic stress. *Ocean Engineering, 22*(1), 105-110. https://doi.org/10.1016/0029-8018(95)80002-6

Aydogdu, M. (2006). Comparison of various shear deformation theories for bending, buckling and vibration of rectangular symmetric cross-ply plate with simply supported edges. *Journal of Composites Material, 40*(12), 2143 – 2155. https://doi.org/10.1177/0021998306062313

Azhari, M., and Kassaei, K. H. (2004). Local buckling analysis of thick anisotropic plates using complex finite strip method. *Iranian Journal of Science and Technology. 28*(B1), 21 – 30, https://www.ijstc.shirazu.ac.ir

Bodaghi, M., and Saidi, A. R. (2010). Levy-type solution for buckling analysis of thick functionally graded rectangular plates based on higher order shear deformation plate theory. *Applied Mathematical Modelling, 34*(11), 3659 – 3673. https://doi.org/10.1016/j.apm.2010.03.016

Barouni, A.K., and Saravanos, D.A. (2016). A layerwise semi-analytical method for modeling guided wave propagation in laminated composite infinite plates with induced surface excitation. *Aerospace Science and Technology, 68*(4), 118 – 141. https://doi.org/10.1016/j.ast.2016.01.023

Bellifa, H., Benrahou, K.H., Hadji, L., Houari, M.S.A., and Tounsi, A. (2016). Bending and free vibration analysis of functionally graded plates using a simple shear deformation theory and the concept of the neutral surface position. *Journal of Brazilian Society of Mechanical Sciences and Engineering, 38*(1), 265 – 275. https://doi.org/10.1007/s40430-015-0354-0

Bencharif, N.E. (1992). Linear and nonlinear deflection analysis of thick rectangular plates using finite differences. *University of Ottawa (Canada), Dissertation Abstracts International, Vol. 68*(7), 46 – 68. https://doi.org/10.20281/ruor-17109

Besseghier, A., Houari, M.S.A., Tounsi, A., and Mahmoud, S.R. (2017). Free vibration analysis of embedded nanosize FG plates using a new nonlocal trigonometric shear deformation theory. *Smart Structure and System Journal, 19*(6), 601– 614. https://doi.org/10.12989/sss.2017.19.6.601

Bhat, R. B. (1985). Natural frequencies of rectangular plates using characteristic orthogonal polynomials in rayleigh-ritz method. *Journal of Sound and Vibrations, Vol. 102*(4), 493 – 499. https://doi.org/10.1016/s0022-460x(85)80109-7

Bryan, G.H. (1890): On the stability of a plane plate under thrusts in its own plane. Proceedings of London Mathematics Society, 22(1), 54–67. https://doi.org/10.1112/plms/s1-22.1.54

Birman, V. (2011). *Plate Structures*. Springer Science + Business Media B.V: New York.

Bouazza, M., Lairedj, A., Benseddiq, N., and Khalki, S. (2016). A refined hyperbolic shear deformation theory for thermal buckling analysis of cross-ply laminated plates. *Journal of Mechanics Research Communications, 73*(3), 117 – 126. https://doi.org/10.1016/j.mechrescom.2016.02.015

Bouazzaa, M., Kenouzaa, Y., Benseddiqc, N., Ashraf, M., and Zenkourd, A.M. (2017). A two-variable simplified nth-higher-order theory for free vibration behavior of laminated plates. Journal of Composite Structures, 182(3), 533 – 541. https://doi.org/10.1016/j.compstruct.2017.09.041

Boukhari, A., Atmane, H.A., Tounsi, A., Bedia, E.A.A., and Mahmoud, S.R. (2016). An efficient Shear deformation theory for wave propagation of functionally graded material plates. *Journal of Structural Engineering Mechanics, 57*(5), 837 – 859. https://doi.org/10.12989/sem.2016.57.5.837

Brandner, R. (2018). Cross laminated timber (CLT) in compression perpendicular to plane: Testing, properties, design and recommendations for harmonizing design provisions for structural timber products. *Journal of Engineering Structures, 171*, 944 - 960. https://doi.org/10.1016/j.engstruct.2018.02.076

Caliri Jr, M. F., Ferreira A.J.M., and Tita V. (2016). A review on plate and shell theories for Laminated and sandwich structures highlighting the finite element method. *Journal of Composite Structures, 156*(1), 63 – 77. https://www.elsevier.com/locate/compstruct

Carrera, E. (2003). Historical review of zig-zag theories for multilayered plates and shells. *Journal of Applied Mechanic Review, 56*(3), 287–308. https://doi.org/10.1115/1.1557614

Carrera, E. (2012). Evaluation of layer-wise mixed theories for laminated plate analysis. *Journal of American Institute of Aeronautics and Astronautics, 36*(5), 830– 839. https://doi.org/10.2514/2.444

Carrera, E., and Demasi, L. (2002). Classical and advanced multilayered plate elements based Upon PVD and RMVT. Part1: Derivation of finite element matrices. *International Journal of Numerical Methods in Engineering, 55*(2), 191–231. https://doi.org/10.1002/nme.492

Chaudhuri, R. A. (2005). Analysis of laminated shear-flexible angle –ply plates. *Journal of Composite Structures, 67*(1), 71 – 84. https://doi.org/10.1016/j.compstruct.2004.01.002

Chen, L. W., and Chen, C. C. (1989). Asymmetric vibration and dynamic stability of bi-modulus thick annular plates. Journal of Computers and Structures, 31(6), 1013 – 1022. https://doi.org/10.1016/0045-7949(89)90286-1

Chen, L. W., and Doong, J. L. (1983). Large amplitude vibration of an initially stressed thick circular plate. *Journal of American Institute of Aeronautics and Astronautics, 21*(7), 1317-1324. https://doi.org/10.1177/0731684405048206

Chen, L. W., and Doong, J. L. (1984). Buckling of clamped circular plates subjected to arbitrary loading condition. *Journal of American Institute of Aeronautics and Astronautics, 23*(2), 13821-1834. https://doi.org/10.1177/07325476893764

Chien, H., Thai, A., Loc, V., Tran, A., Dung, T., Tran, C., Nguyen-Thoi, A., and Nguyen-Xuan, B. H. (2012). Analysis of laminated composite plates using higher order shear deformation plate theory and node-based smoothed discrete shear gap method. *Journal of Applied Mathematical modeling, 36*(11), 5657-5677. https://doi.org/10.1016/j.apm.2012.01.003

Chikh, A., Hebali, H., Tounsi, A., and Mahmoud, S.R. (2017). Thermal buckling analysis of cross-ply-laminated plates using a simplified higher-order shear deformation theory (HSDT). *Smart Structure and System journal, 19*(3), 289– 297. https://doi.org/10.12989/sss.2017.19.3.289

Chikalthankar, S. B., Sayyad, I. I., and Nandedkar, V. M. (2013). Analysis of orthotropic plate by refined plate theory. *International Journal of Engineering and Advanced Technology, 2*(6), 310-315. https://www.ijeat.org

Chinosi, C., Croce, L.D., Cinefra, M., and Carrera, E. (2016). Approximation of anisotropic multi-layered plates through RMVT and MITC elements. *Journal of Composite Structures, 158*(3), 252 – 261. https://doi.org/10.1016/j.compstruct.2016.09.032

Cho, M., and Kim, J., (1996). Matching technique of postprocess method using displacement field of higher-order plate theories. *Journal of Composite Structures, 34*(1), 185 – 196. https://doi.org/10.1016/s0263-8223(98)00099-3

Damnjanovica, E., Nefovska-Danilovica, M., Petronijevica, M., and Marjanovica, M. (2017). Application of the dynamic stiffness method in the vibration analysis of stiffened composite plates. *Proceedia Engineering: X International Conference on Structural Dynamics EURODYN, 199*(1), 224 – 229. https://doi.org/10.1016/euro654-7698(76)00066-2

Daouadji, T. H., Tounsi, A., Bedia, E.I., and Abbes, A. (2013). A new higher order shear deformation model for static behaviour of functionally graded plates. *Journal of Advances in Applied Mathematics and Mechanics, 5*(3), 351-364. https://doi.org/10.4208/aamm.11-m11176

Desai, Y.M., Ramtekkar, G.S., and Shah, A.H., (2003). Dynamic analysis of laminated composite plates using a layer-wise mixed finite element model. *Journal of Composite Structure, 59*(2), 237– 249. https://doi.org/10.1016/s0263-8223(02)00121-6

Di-Sciuva, M. (1984). A refined transverse shear deformation theory for multilayered anisotropic Plates. *Atti della Accademia delle science di Torino, 118*(1), 279–295. https://www.semanticscholar.org

DiSciuva, M. (1986): Bending, vibration and buckling of simply supported thick multilayered Orthotropic plates: an evaluation of a new displacement model. Journal of Sound and Vibration, Vol. 105, pp. 425– 442. https://doi.org/10.1016/0022-460x(86)90169-0

Diveyev, B., Konyk, S., and Crocker, M.J. (2018). Dynamic properties and damping predictions for laminated plates: High order theories - Timoshenko beam. *Journal of Sound and*

Vibration, 413(4), 173 – 190. https://doi.org/10.1016/j.jsv.2017.10.017

Enem, J. I. (2018). Nonlinear Analysis of Isotropic Rectangular Thin Plates using Ritz Method. Ph.D Thesis submitted to postgraduate school, Federal University of Technology Owerri. https://www.futospace.futo.edu.ng

Ezeh, J. C., Ibearugbulem, O. M., Njoku, K. O., and Ettu, L. O. (2013). Dynamic analysis of isotropic SSSS plate using Taylor series shape function in Galerkin's functional. *Internal Journal of Emerging Technology and Advanced Engineering, 3*(5), 372 – 375. https://www.pdfs.semanticscholar.org

Fazzolari, F.A., and Carrera, E. (2011). Advanced variable kinematics Ritz and Galerkin formulations for accurate buckling and vibration analysis of anisotropic laminated composite plates. *Journal of Composite Structures, 94*(1), 50 – 67. https://doi.org/10.1016/j.compstruct.2011.07.018

Gajewski, A. (2002). Vibration and stability of annular plates in non-linear creep conditions. *Journal of Sound and Vibration, 249*(3), 447-463. https://doi.org/10.1006/jsvi.2001.3876

Ganapathi, M., Patel, B. P., and Makhecha, D. P. (2004). Nonlinear dynamic analysis of thick composite/sandwich laminates using an accurate higher-order theory. *Journal of Composites Part B: Engineering, 35*(1), 345– 355. https://doi.org/10.1016/s1359-8368(02)00075-6

Ghavanloo, E., and Fazelzadeh, S. A. (2013). Free vibration analysis of orthotropic doubly-curved shallow shells based on the gradient elasticity. *Journal of Composites Part B: Engineering, 45*(1), 1448 – 1457. https://doi.org/10.1016/j.compositesb.2012.09.054

Ghorashi, M., and Daneshpazhooh, M. (2001). Limit analysis of variable thickness circular plates. *Journal of Computers and Structures, 79*(2), 461-468. https://www.elsevier.com/locate/compstruc

Ghugal, Y. M., and George, J. T. (2010). Cylindrical bending of thick isotropic plates using trigonometric shear deformation theory. *Journal of Advances and Trends in Structural Engineering, Mechanics and Computation, 54*(1), 187-199. https://www.books.google.com.ng

Ghugal, Y. M., and Pawar, M. D. (2011). Buckling and vibration of plates by hyperbolic shear deformation theory. Journal of Aerospace Engineering and Technology, 1(1-3), 6 – 24. https://doi.org/10.37591/.v1i1-3.724

Ghugal, Y. M., and Sayyad, A. S. (2010). A static flexure of thick isotropic plates using trigonometric shear deformation theory. *Journal o Solid Mechanics, 2*(1), 79 – 90. https://doi.org/wwwjsm.paper.pdf

Ghugal, Y. M., and Sayyad, A. S. (2011a). Free vibration of thick orthotropic plate using trigonometric shear deformation theory. *Latin American Journal of Solids and Structures, 8*(3), pp. 229-243. https://doi.org/10.1590/s1679-78252011000300002

Ghugal, Y. M. and Sayyad, A. S. (2011b): Cylindrical bending of thick orthotropic plate using trigonometric shear deformation theory. *International Journal of Applied Mathematics and Mechanics, 7*(5), 98 – 116. https://www.researchgate.net/publication/262004807

Ghugal,Y.M., and Shimpi, R.P. (2002). A review of refined shear deformation theories of isotropic and anisotropic laminated plates. *Journal of Reinforced Plastics and Composites, 21(1)*, 775–813. https://doi.org/10.1177/073168402128988481

Goswami, S., and Becker, W. (2013). A new rectangular finite element formulation based on higher order displacement theory for thick and thin composite and sandwich plates. *World Journal of Mechanics, 3*(2), 194-201. https://doi.org/10.4236/wjm.2013.33019

Grover, N., Maiti D.K., and Singh B.N. (2013). A new inverse hyperbolic shear deformation theory for static and buckling analysis of laminated composite and sandwich plates. *Journal of Composite Structures, 95*(3), 667 – 75. https://doi.org/10.1016/j.compstruct.2012.08.012

Gunjal, S. M., Hajare, R. B., Sayyad, A. S., and Ghodle, M. D. (2015). Buckling analysis of thick plates using refined trigonometric shear deformation theory. *Journal of Materials and Engineering Structures, 2*(1), 159–167. https://www.core.ac.uk

Gupta, U. S., and Ansari, A. H. (1997). Axsymmetric vibrations of polar orthotropic circular plates of parabolically varying profile with restrained elastic edge. *Journal of Pure Mathematics. 28*(11), 1513-1534. https://www.insa.nic.in

Gupta, U. S., and Ansari, A. H. (1998). Free vibration of polar orthotropic circular plates of variable thickness with elastically restrained edge. *Journal of Sound and Vibrations, 213*(3), 429-445. https://doi.org/10.1016/jsvi.1997.1463

Gupta, U. S., and Goyal, N. (1999). Forced asymmetric response of linearly tapered circular plates. *Journal of Sound and Vibrations, 220*(4), 641-657. https://doi.org/10.1006/jsvi.1998.1960

Gupta, U. S. and Lai, R. (1983): Axsymmetric vibrations of polar orthotropic Mindlin annular plates of variable thickness. Journal of Sound and Vibrations, Vol. 98(4), 565-573. https://doi.org/10.1016/jsvi.1992.1923

Guruswamy, P., and Yang, T. Y. (1979). A sector finite element for dynamic analysis of thick plates. *Journal of Sound and Vibration, 62*(4), 505-516. https://doi.org/10.1016/002-460x(79)90459-0

Hashemi, S. H., and Arsanjani, M. (2004). Exact characteristic equations for some of classical boundary conditions of vibrating moderately thick rectangular plate. *International Journal of Solids and Structures, 42*(3-4), 819–853. https://doi.org/10.1016/j.ijsolstr.2004.06.063

He, Y., Xiao, Y., Liu, Y., and Zhang, Z. (2018). An efficient finite element method for computing modal damping of laminated composites: Theory and experiment. *Journal of Composite Structures, 184*(4), 728 – 741. https://doi.org/10.1016/j.compstruct.2017.10.024

Hong G. M., Wang, C. M., and Tan, T. J. (1993). Analytical buckling solutions of circular Mindlin plates: Inclusion of in-plane pre-buckling deformation. *Archive of Applied Mechanics, 63*(8), 534-542. https://doi.org/10.1007/BF00804755

Huanga, W, Zhangd, W, Chend, T, Jiangd, X and Liu, J. (2018). Dynamic response of circular composite laminates subjected to underwater impulsive loading. *Journal of Composites Part A Engineering, 109*(1), 63 – 74. https://doi.org/10.1016/j.compositesa.2018.02.043

Hutchen, J. R. (1984). Vibration of thick circular plates, exact versus approximate solution. *Journal of Applied Mechanics, 51*(3), 581 – 585. https://www.nsr.cd.org

Ibearugbulem, O. M., Ezeh, J. C., Ettu, L. O. and Gwara L. S. (2018). Bending Analysis of Rectangular Thick Plate Using Polynomial Shear Deformation Theory. IOSR Journal of Engineering, 8(9), 53 – 61. https://www.iosrjen.org

Ibearugbulem, O. M., Ibeabuchi, V. I., and Njoku, K. O. (2014). Buckling analysis of SSSS stiffened rectangular isotropic plates using work principle approach. *International Journal of Innovative Research and Development, 3*, 169 – 176. https://www.internationaljournalcorner.com

Ibearugbulem, O.M. (2016). *Note on rectangular plate analysis*. Lambert Academic Publishing: Deutschland, Germany.

Ibearugbulem, O. M. (2012). Application of a direct variational principle in elastic stability of rectangular flat thin plates. Ph.D Thesis submitted to postgraduate school, Federal University of Technology Owerri. https://www.futospace.futo.edu.ng

Ibearugbulem O. M., and Ezeh J. C. (2012). Instability of axially compressed CCCC thin Rectangular plate using Taylor-Maclaurin's series function on Ritz method. *Academic Research International, 4*(1), 346 – 351. https://www.googlescholar.com

Ibearugbulem, O. M., Osadebe, N. N., Ezeh, J. C., and Onwuka, D. O. (2011): Buckling analysis of axially compressed SSSS thin rectangular plate using Taylor-Mclaurin shape function. *International Journal of Civil and Structural Engineering, 2*(2), 1 -10. https://www.semanticscholar.org

Irie, T. Yamada, G., and Takagi, K. (1982). Natural frequencies of thick annular plates. *Transactions of the American Society of Mechanical Engineers, Journal of Applied Mechanics, 49*(3), 633-638. https://doi.org/10.1115/1.3162539

Iyengar, N. G. (1988). *Structural stability of columns and plates*. Ellis Horwood: Chichester, United Kingdom

Ivo, S., Nikola, V., and Neven, H. (2014). Modified Mindlin plate theory and shear locking-free finite element formulation. *Journal of Mechanics Research Communications, 55*(1), 743-754. https://doi.org/10.1016/j.mechrescom.2013.10.007

Jabareen, M., Neubauer, A.P., and Mtanes, E. (2018). A solid-shell cosserat point element for the analysis of geometrically linear and nonlinear laminated composite structures. *Journal of Finite Element in Analysis and Design*, 142(1), 61 – 80. https://doi.org/10.1016/j.finel.2017.12.006

Jam, J. E., Maleki, S., and Andakshideh, A. (2012). Non-linear bending analysis of moderately thick functionally graded plates using generalized differential quadrature method. *International Journal of Aerospace Sciences, 1*(3), 49-56. https://doi.org/10.5923/j.aerospace.20120103.04

Joshana, Y.S., Grovera, N., and Singhb, B.N. (2017a). A new non-polynomial four variable shear deformation theory in axiomatic formulation for hygro-thermo-mechanical analysis of laminated composite plates. *Journal of Composite Structures, 182*(1), 685 – 693. https://doi.org/10.1016/j.compstruct.2017.029

Joshana, Y.S., Grovera, N., and Singhb, B.N. (2017b). Analytical modelling for thermo-mechanical analysis of cross-ply and angle-ply laminated composite plates. *Journal of Aerospace Science and Technology, 70*(1), 137 – 151. https://doi.org/10.1016/j.ast.2017.07.041

Kang, J. H., and Leissa, A. W. (1998). Three-dimensional vibrations of thick, linearly tapered, annular plates. *Journal of Sound and Vibration, 217*(5), 927-944. https://doi.org/10.1016/jsv.1998.1803

Kant, T., and Pandya, B. N. (1988). A simple finite element formulation of a higher-order theory for unsymmetrically laminated composite plates. *Journal of Composite Structures, 9*(3), 215 – 246. https://doi.org/10.1016/0263-8223(88)90015-3

Kant, T., and Swaminathan, K. (2002). Analytical solutions for the static analysis of laminated composite and sandwich plates based on higher order refined theory. *Journal of Composite Structures, 56*(1), 329 – 344. https://www.citeseerx.ist.psu.edu

Karama, M., Afaq, K. S., and Mistou, S. (2003). Mechanical behavior of laminated composite beam by new multi-layered laminated composite structures model with transverse shear stress continuity. *International Journal of Solids and Structures, 40*(6), 1525–1546. https://doi.org/10.1016/s0020-7683(02)00647-9

Kazanci, Z. (2016). A review on the response of blast loaded laminated composite plates. *Journal of Progress in Aerospace Science, 81*(6), 49 – 59. https://doi.org/10.1016/j.paerosci.2015.12.004

Kazemi, M., and Verchery, G. (2016). Design of composite laminated plates for maximum buckling load with stiffness and elastic modulus constraints. *Journal of Composite Structures, 148*(1), 27 – 38. https://doi.org/10.1016/j.compstruct.2016.03.051

Khdeir A.A. (1989). Comparison between shear deformable and Kirchhoff theories for bending, buckling and vibration of antisymmetric angle-ply laminated plates. *Journal of Composite Structures, Vol. 13*(3), 159–72. https://doi.org/10.1016/0263-8223(89)90001-9

Khdeir, A. A., and Reddy J. N. (1989). Exact solutions for the transient response of symmetric cross-ply laminates using a higher-order plate theory. *Journal of Composites Science and Technology, 34(2)*, 205 – 224. https://doi.org/10.1016/0266-3538(89)90029-8

Khezri, M., Gharib, M., Bradford, M.A., and Vrcelj, Z. (2015). Analysis of thick and orthotropic rectangular laminated composite plates using a state-space-based generalised RKP-FSM. *Journal of Composite Structures, 133*(1), 691 – 706. https://doi.org/10.1016/j.compstruct.2015.07.035

Khoa, N. N., and Thinh, T. I. (2007). Finite element analysis of laminated composite plates using higher order shear deformation theory. *Vietnam Journal of Mechanics VAST, 29*(1), 47 – 57. https://doi.org/10.1016/pdfs.semanticscholar.org

Kim, S. E., Thai, H. T., and Lee, J. (2009). Buckling analysis of plates using two variable refined plate theory. *Thin-Walled Structures 47*(4), 455 - 462. https://doi.org/10.1016/j.tws.2008.08.002

Kirchhoff, G.R. (1850). Uber das gleichgewichi und die bewegung einer elastishem scheibe. *Journal Fuer die Reine und Angewandte Mathematik, 40*, 51–88. https://doi.org/10.1515/crit.1850.40.51

Kulikov, G.M., and Plotnikova, S.V. (2012). Exact 3-D stress analysis of laminated composite Plates by sampling surfaces method. *Journal of Composite Structures, 94*(2), 3654–3663. https://doi.org/10.1016/j.compstruct.2012.06.006

Kumar, J. S., Raju, T. D., and Reddy, K. V. K. (2011). Vibration analysis of composite laminated plates using higher order shear deformation theory with zig-zag function. *Indian Journal of Science and Technology, 4*(8), 960-966. https://www.indjst.org

Kumar, A., Panda, S., Kumar, S., and Chakraborty, D. (2015). A design of laminated composite plates using graded orthotropic fiber-reinforced composite plies. *Journal of Composite Part B Engineering, 79(2)*, 476 – 493. https://doi.org/10.1016/j.compositesb.2015.05.009

Kumar, G., and Shapiro, V. (2015). Efficient 3-D analysis of laminate structures using ABD-equivalent material models. *Journal of Finite Element in Analysis and Design,106*(2), 41 – 51. https://doi.org/10.1016/j.finel.2015.07.009

Lan, X. J., and Feng, Z. H. (2012). Analysis of deflections and stresses for laminated composite plates based on a new higher-order shear deformation theory. *Journal of Applied Mechanics of Materials, 1*(1), 226 – 228. https://doi.org/10.4028/www.scientific.net/AMM.226-228.1725

Laura, P. A. A., and Gutierrez, R. H. (1995). Analysis of vibration circular plates of no uniform thickness by the method of differential quadrature. *Ocean Engineering 22(1)*, 97-100. https://www.oceanengineering .com

Lee, H., and Ng, T. Y. (1995). Vibration and critical speeds of a spinning annular disk of varying thickness. *Journal of Sound and Vibration, 187*(1), 39-50. https://doi.org/10.1016/jsvi.1995.0501

Lee, T., Kim, C., Pyo, J., Kim, M.S., and Kim, T. (2017). Effect of anisotropic thermo-elastic properties of woven-fabric laminates on diagonal war-page of thin package substrates. *Journal of Composite Structures, 176*(2), 973 – 981. https://doi.org/10.1016/j.compstruct.2017.06.014

Lee, K.H., Senthilnathan, N.R., Lim, S.P., and Chow, S.T. (1990). An improved zig-zag model for the bending of laminated composite plates. *Journal of Composite Structures, 15*(1), 137–148. https://doi.org/10.1016/0263-8223(90)90003-W

Lekhnitskiy, S.G. (1968). *Anisotropic plates (English translation of the original Russian work).* Gordon and Breach: New York.

Levy, S. (1942). Bending of rectangular plates with large deflections. *Technical Report of National Advisory Committee for Aeronautics; Washington, DC,* https://www.ntrs.nasa.gov. Document ID: 19930081641

Li, J., and Narita, Y. (2013). Analysis and optimal design for supersonic composite laminated plate. *Journal of Composite Structures, 101*(1), 35 – 46. https://doi.org/10.1016/j.compstruct.2013.01.022

Liew, K. M., Xiang, Y., Wang C. M., and Kitipornchai, S. (1993). Flexural vibration of shear deformable circular and annular plates on ring supports. *Computer Methods in Applied Mechanics and Engineering, 110*(3-4), 301-315. https://doi.org/10.1016/0045-7825(93)90211-F

Lisboa, T.D.V., and Marczak, R.J. (2017). A recursive methodology for the solution of semi-analytical rectangular anisotropic thin plates in linear bending. *Journal of Applied Mathematical Modelling, 48*(1), 711 – 730. https://doi.org/10.1016/j.apm.2017.04.020

Lisboa, T. D. V., and Marczak, R.J. (2018). Adomian decomposition method applied to anisotropic thick plates in bending. *European Journal of Mechanics / Solids A, 70*(1), 95 – 150. https://www.researchgate.net

Liu, D., and Li, X. (1996). An overall view of laminate theories based on displacement hypothesis. *Journal of Composite Materials, 30*(1), 1539 – 1561. https://doi.org/10.1177/002199839603001402

Liu, F. L. (2000). Static analysis of thick rectangular laminated plates: Three dimensional elastic solutions via differential quadrature element method. *International Journal of Solid Structures, 37*(1), 7671 – 7688. https://www.researchgate.net

Loredo, A. (2014). Exact 3d solution for static and damped harmonic response of simply supported general laminates. *Journal of Composite Structures, Vol. 108*(1), 625 – 634. https://doi.org/10.1016/j.compstruct.2013.09.059

Love, A.E.H. (1888). The small free vibration of and deformation of thin elastic shell. *Philos. Trans. R. Soc. A Math. Phys. Eng. Sci., 179*(1) 491 – 546. https://doi.org/10.1098/rsta.1888.0016

Mahi, A., Bedia, E.A.A., and Tounsi, A. (2015). A new hyperbolic shear deformation theory for bending and free vibration analysis of isotropic, functionally graded, sandwich and laminated composite plates. *Journal of Applied Mathematics and Model, 39*(9), 2489–2508. https://doi.org/10.1016/j.apm.2014.10.045

Mantari, J.L., Oktem, A.S., and Soares, C.G. (2012). A new higher-order shear deformation theory for Sandwich and composite laminated plates. *Journal of Composites Part B Engineering, 43*(2), 1489– 1499. https://doi.org/10.1016/j.compositesw.2011.07.017

Mantari, J.L., and Ore, M. (2015). Free vibration of single and sandwich laminated composite plates by using a simplified first-order shear deformation theory(FSDT). *Journal of Composite Structures, 132*(4), 952– 959. https://doi.org/10.1016/j.compstruct.2015.06.035

Mantari, J.L., and Soares, C.G. (2013). Generalized layer-wise HSDT and finite element Formulation for symmetric laminated and sandwich composite plates. *Journal of Composite Structures, 105*(2), 319–331. https://doi.org/10.1016/j.compstruct.2013.04.042

Matikainen, M. K., Schwab, A. L., and Mikkola, A. M. (2009). Comparison of two moderately thick plate elements based on the absolute nodal coordinate formulation. *Multi-body Dynamics ECCOMAS Thematic Conference*, Warsaw, Poland. https://www.researchgate.net

Matsunaga, H. (1992). The application of a two dimensional higher-order theory for the analysis of a thick elastic plate. *Journal of Computers and Structures, 45*(1), 633 – 648. https://doi.org/10.1016/0045-7949(92)90482-F

Mauricio, F., Caliri Jr., M.F., Antonio, J.M., Ferreira, A.J.M., and Tita, V. (2016). A review on plate and shell theories for laminated and sandwich structures highlighting the Finite Element Method. *Journal of Composite Structures, 156*(1), 63 – 77. https://doi.org/10.1016/j.compstruct.2016.02.036

Merdaci, S., Tounsi, A., and Bakora, Y. A. (2016). Novel four variable refined plate theory for

Laminated composite plates. *Steel and Composite Structures International Journal, 18*(4), 713–732. https://doi.org/10.12989/scs.2016.22.4.713

Mindlin R.D. (1951). Influence of rotary inertia and shear on flexural motions of isotropic elastic plates. *Journal of Applied Mechanics, 18*, 31 – 38.

Mohammadi, M., Saidi, A. R., and Jomehzadeh, E. (2010). A novel analytical approach for buckling analysis of moderate thick functionally graded rectangular plates with two opposite edge simply supported. *Proceedings of the Institution of Mechanical Engineers Part C Journal of Mechanical Engineering Science, 224(1)*, 1989 – 1996. https://doi.org/10.1243/09544062JMES1804

Murakami, H. (1986). Laminated composite plate theory with improved in-plane responses. *Journal of Applied Mechanics, 53*(1), 661– 666. https://doi.org/10.1115/1.3171828

Murthy, M. V. V. (1981). An improved transverse shear deformation theory for laminated anisotropic plates. *NASA Technical Paper*. https://www.ntrs.nasa.gov

Murty, A. V. K (1984). Toward a consistent beam. *American Institute of Aeronautics and Astronautics AIAA Journal, 22*(1), 811-816. https://www.eprints.library.lisc.ernet.in

Nali, P., Carrera, E., and Lecca, S. (2011). Assessments of refined theories for buckling analysis of laminated plates. *Journal of Composite Structures, 93*(3), 456 – 464. https://doi.org/10.1016/j.compstruct.2010.08.035

Narayana, A. L., Kumar, R. V., and Rao, G. K. (2018). Effect of volume fraction on the thermal buckling analysis of laminated composite plate with square/rectangular cutout. *Materials Today: Proceedings, 5*(1), 5819 – 5829. https://www.materialstoday.com/proceedings

Neetha, R., Raju, K. K., and Rao, G. V. (1986). Post buckling analysis of moderately thick annular plates. *Journal of Computers and Structures,* (6), 869 – 870. https://doi.org/10.1016/0045-7949(86)90256-7

Nguyen, S.N., Lee, J., and Cho, M. (2016). A triangular finite element using Laplace transform for viscoelastic laminated composite plates based on efficient higher-order zigzag theory. *Journal of Composite Structures, 155*(2), 223 – 244. https://doi.org/10.1016/j.compstruct.2016.07.051

Nguyen-Van, H., Mai-Duy, N., Karinasena, W., and Tran-Cong, T. (2011). Buckling and vibration analysis of laminated composite plate/shell structures via smoothed quadrilateral flat shell element with in-plane rotations. *Journal of Computers and Structures, 89*(7-8), 612-625. https://doi.org/10.1016/j.compstruct.2011.01.005

Nonn, S., Schagerla, M., Zhaoa, Y., Gschossmanna, S., and Kraloveca, C. (2018). Application of electrical impedance tomography to an anisotropic carbon fiber-reinforced polymer composite laminate for damage localization. *Journal of Composites Science and Technology, 160*(3), 231 – 236. https://doi.org/10.1016/j.compscitech.2018.03.031

Noor,A.K., and Burton,W.S. (1989). Stress and free vibration analyses of multilayered composite plates. *Journal of Composite Structures, 11(2)*, 183– 204. https://doi.org/10.1016/0263-8223(89)900585

Noor, A.K. (1973). Free vibrations of multilayered composite plates. *Journal of American Institute of Aeronautics and Astronautics, 11*(7), 1038–1039. https://doi.org/10.2514/3.6868

Nosier, A., Kapania, R.K., and Reddy, J.N. (1993). Free vibration analysis of laminated plates using a layer-wise theory. *Journal of American Institute of Aeronautics and Astronautics, 31*(6), 2335– 2346. https://doi.org/10.2514/3.11933

Pagano, N. (1969). Exact solutions for composite laminates in cylindrical bending. *Journal of Composite Material, 3*(1), 398– 411. https://doi.org/10.1177/002199836900300304

Pagano, N. (1970). Exact solutions for rectangular bidirectional composites and sandwich plates. *Journal of Composite Materials, 4*(2), 20– 34. https://doi.org/10.1177/02199837000400102

Pai, P. (1995). A new look at shear correction factors and warping functions of anisotropic Laminates. *International Journal of Solids and Structures, 32*(3), 2295– 2313. https://doi.org/10.1016/0020-7683(94)00258-X

Petrolo, M., Cinefra, M., Lamberti, A., and Carrera, E. (2015). Evaluation of mixed theories for laminated plates through the axiomatic/asymptotic method. *Journal of Composites Part B Engineering, 76*(2), 260 – 272. https://doi.org/10.1016/j.compsitesb.2015.02.027

Phan, N. D., and Reddy J. N. (1985). Analysis of laminated composite plates using a higher order shear deformation theory. *International Journal of Numerical Methods in Engineering, 21*(4), Pp. 2201 – 2219. https://doi.org/10.1002/nme.1620211207

Plagianakos, T.S., and Saravanos, D.A. (2009). Higher-order layer-wise laminate theory for the Prediction of inter laminar shear stresses in thick composite and sandwich composite plates. *Journal of Composite Structures, 87*(3) 23–35. https://doi.org/10.1016/j.compstruct.2007.12.002

Raju, K. K. (1996). Thermal post buckling of linearly tapered moderately thick isotropic circular plates. *Journal of Computers and Structures, 58*(2), 655-658. https://doi.org/10.1016/0045-7949(95)00150-F

Raju, K. K., and Rao, G. (1986). Post buckling analysis of linearly tapered, moderately thick circular plates. *Journal of Computers and Structures, 22*(3), 307-310. https://www.fdocuments.in

Raju, T. D., and Kumar, J. S. (2011a). Bending analysis of composite laminated plates using higher order shear deformation theory with zig-zag function. *ARPN Journal of Engineering and Applied Science, 6*(12), 106-110. https://www.googlescholar.net

Raju, T. D., and Kumar, J. S. (2011b). Transient analysis of composite laminated plates using higher ordershear deformation theory with zig-zag function. *International Journal of Applied Engineering Research, 2*(2), 562-569. https://www.ipublishing.co.in

Rakocevic, M., Popovic, S., and Ivanisevic, N. (2017). A computational method for laminated composite plates based on layerwise theory. *Journal of Composite Part B Engineering, 122*(2), 202 – 218. https://doi.org/10.1016/j.compositesb.2017.03.044

Rango, R.F., Bellomo, F.J., and Nallim, L.G. (2015). A variational Ritz formulation for vibration analysis of thick quadrilateral laminated plates. *International Journal of Mechanical Science, 104*(9), 60 -74. https://doi.org/10.1016/j.ijmecsci.2015.09.018

Rayleigh, J. W. S. (1894). *The theory of sound* (Second Edition). Macmilian and CO: London.

Reddy, J.N., and Arciniega, R. A. (2004). Shear deformation plate and shell theories: from Stavsky to present. *Journal of Mechanics of Advanced Material and Structures, 11*(6), 535–582. https://doi.org/10.1080/15376490490452777

Reddy, J. N. (1984). A simple higher-order theory for laminated composite plate. *Journal of Applied Mechanics, 51*(1), 745 – 752. https://doi.org/10.1115/1.3167719

Reddy, J. N., and Liu, C. F. (1985). A higher order shear deformation theory of laminated elastic shells. *International Journal of Engineering Science, 23*(1), 319 – 330. https://doi.org/10.1119/1.4178726

Reddy J. N. (2004a). *Theory and analysis of elastic plates and shells* (Second edition). CRC Press Taylor and Francis Group: Boca Raton, Florida

Reddy J. N. (2004b). *Mechanics of laminated composite plates and shell "theory and analysis"* (Second edition). CRC Press: Washington D.C.

Reddy, B. S. (2014). Bending behaviour of exponentially graded material plates using new higher order shear deformation theory with stretching effect. *International Journal of Engineering Research,* 8(3), 124-131. https://doi.org/10.1155/2014/980356

Reissner, E. (1994). On the theory of bending of elastic plates. *Journal of Mathematical Physics, 23*(1), 184–191.

Reissner, E. (1945). The effect of transverse shear deformation on the bending of elastic plates. *Journal of Applied Mechanics, 12*(2), 69–77.

Sarangan, S., and Singh, B.N. (2017). Evaluation of free vibration and bending analysis of laminated composite and sandwich plates using non-polynomial zigzag models: *C*0Finite element formulation. *Journal of Aerospace Science and Technology, 68*(6), 496 – 508. https://doi.org/10.1016/j.ast.2017.06.001

Sadrnejad, S. A., Daryan, A. S., and Ziaei, M. (2009). Vibration equations of thick rectangular plates using Mindlin plate theory. *Journal of Computer Science, 5*(11), 838-842. https://www.citeseerx.ist.psu.edu

Sahoo, R., and Singh, B.N. (2013). A new shear deformation theory for the static analysis of laminated composite and sandwich plates. *International Journal of Mechanical Science, 75*(8), 324 – 336. https://doi.org/10.1016/j.ijmecsci.2013.08.002

Sahoo, R., and Singh, B.N. (2015). Assessment of inverse trigonometric zigzag theory for Stability analysis of laminated composite and sandwich plates. *International Journal of Mechanical Sciences, 101-102*(7), 145 – 154. https://doi.org/10.1016/j.ijmecsci.2015.07.023

Sayyad, A. S. (2011). Comparison of various shear deformation theories for the free vibration of thick isotropic beams. *International Journal of Civil and Structural Engineering, 2*(1), 85 – 97. https://www.citeseerx.its.psu.edu

Sayyad, A. S. (2011). Comparison of various refined beam theories for the bending and free Vibration analysis of thick beams. *Journal of Applied and Computational Mechanics, 5*(2), 217 – 230. https://www.kme.zcu.cz

Sayyad, A. S., and Ghugal, Y. M. (2012a). Bending and free vibration analysis of thick isotropic plates by using exponential shear deformation theory. *Journal of Applied and Computational Mechanics, 6*(1), 65–82. https://www.researchgate.net/publication/262004483

Sayyad, A. S., and Ghugal, Y. M. (2012b). Buckling analysis of thick isotropic plates by using exponential shear deformation theory. *Journal of Applied and Computational Mechanics, 6*(2), 185 – 196. https://www.core.ac.uk

Sayyad, A. S., and Ghugal, Y. M. (2014). Buckling and free vibration analysis of orthotropic plates by using exponential shear deformation theory. *Latin American Journal of Solids and Structures 11*(8), 1298-1314. https://doi.org/10.1590/S1679-78252014000800001

Sayyad, A. S., Shinde, B. M., and Ghugal, Y. M. (2016). Bending, vibration and buckling of laminated composite plates using a simple four variable plate theory. *Latin American journal of solids and structures, 13*(3), 257-269. https://doi.org/10.1590/1679-78252241

Sayyad, I. I., Chikalthankar, S. B., and Nandedkar, V. M. (2013). Bending and free vibration analysis of isotropic plate using refined plate theory. *Bonfring International Journal of Industrial Engineering and Management Science, 3*(2), 40 – 47. https://doi.org/10.9756/BIJIEMS.4390

Setoodeh, A. R., and Karami, G. (2004). Static free vibration and buckling analysis of anisotropic thick laminated composite plates on distributed and point elastic support using a 3-D layer-wise finite element method. *Journal of Engineering Structures, 26*(2), 211-220. https://doi.org/10.1016/j.engstruct.2003.09.009

Shames, I. H., and Dym, C. L. (1991). *Energy and finite element method in structural mechanics* (1^{st} Edition). New Age International Limited: New Delhi.

Shinde, B. M., Sayyad, A. S., and Ghumare, S. M. (2015). A refined shear deformation theory for bending analysis of isotropic and orthotropic plates under various loading conditions. *Journal of Material and Engineering Structures, 2*(1), 3 – 15. https://www.revue.ummto.dz

Shimpi, R. P., and Patel, H. G. (2006). A two variable refined plate theory for orthotropic plate analysis. *International Journal of Solids and Structures, 43*(22-23), 6783-6799. https://doi.org/10.1016/j.ijsolstr.2006.02.007

Shufrin, I., Rabinovitch, O., and Eisenberger, M. (2008). Buckling of symmetrically laminated rectangular plates with general boundary conditions – a semi-analytical approach. *Journal of Composite Structures, 82*(4), 521–531. https://doi.org/10.1016/j.compstruct.2007.02.003

Sokolnikoff, I.S. (1956). *Mathematical theory of elasticity* (2nd edition). McGraw-Hill: New York.

Soldatos, K. P. (1992). A transverse shear deformation theory for homogeneous monoclinic plates. *Acta Mechanica, 94*(3), 195 – 220. https://doi.org/10.1007/BF01176650

Southwell, R.V., and Scan, S. (1924). On the stability under shearing forces of a flat elastic strip. *Proceedings of Royal Society of London, A105*, 568-582. https://doi.org/10.1098/rspa.1924.0040

Sreehari, V.M., and Maiti, D.K. (2016). Buckling and post buckling characteristics of laminated composite plates with damage under thermo-mechanical loading. *Journal of Structures, 6*(12), 9 - 19. https://doi.org/10.1016/j.istruc.2016.01.002

Srinivas, S., JogaRao, C.V., and Rao, A.K. (1970). An exact analysis for vibration of simply supported homogeneous and laminated thick rectangular plates. *Journal of Sound and Vibration, 12*(4), 187– 199. https://doi.org/10.1016/0022-460X(70)90089-1

Stanic, A., Hudobivnik, B., and Brank, B. (2016). Economic-design optimization of cross laminated timber plates with ribs. *Journal of Composite Structures, 154*(2), 527 – 537. https://doi.org/10.1016/j.compstruct.2016.07.072

Suzuki, K., Yamaguchi, T., Hirano, Y., Kosawada, T., and Takahashi, S. (1983). Vibrations of Mindlin's circular plates with variables thickness. *Bulletin of Japan Society of Mechanical Engineering, 26*(213), 424-431. https://doi.org/10.1299/jsme1958.26.424

Swaminathan, K., and Sangwai, G. R. (2009). Higher order refined model with 9 degree of freedom for the transverse stress analysis of anti-symmetric angle ply laminated composite plates. *International Journal of Earth Science and Engineering, 2*(4), 367-375. https://doi.org/10.1017/ij.earscieng.2009.06.002

Szilard, R. (2004). *Theories and applications of plate analysis: Classical, numerical and engineering methods*. John Wiley & Sons, Inc.: New Jersey

Takahashi, S., Suzuki, K., and Katsuyoshi, S. (1981). Vibrations of Mindlin's circular plates with thickness varied along radius. *Bulletin of Japan Society of Mechanical Engineering, 24*(187), 229 - 235. https://doi.org/10.1299/jsme1958.24.229

Thai, H. T., and Choi, D. H. (2012). An efficient and simple refined theory for buckling analysis of functionally graded plates. *Applied Mathematical Modelling, 36*(3), 1008–1022. https://doi.org/10.1016/j.apm.2011.07.062

Thai, H. T., and Kim, S. E. (2011). Levy-type solution for buckling analysis of orthotropic plates based on two variable refined plate theory. *Journal of Composite Structures, 93*(7), 1738-1746. https://doi.org/10.1016/j.compstruct.2011.01.012

Thai, H. T., and Vo, T. (2013). A new sinusoidal shear deformation theory for bending, buckling and vibration of functionally graded plates. *Applied Mathematical Modelling, 37*(5), 3269 -3281. https://doi.org/10.1016/j.apm.2012.08.008

Thompson, W.T. (1973). *Theory of vibrations and applications*. Prentice-Hill: Englewood Cliffs, New Jersey.

Timoshenko, S.P. (1953). *History of strength of materials.* McGraw-Hill: New York.

Timoshenko, S.P., and Woinowsky-Krieger, S. (1959). *Theory of plates and shells* (2nd edition). McGraw-Hill: New York.

Timoshenko, S.P., and Gere, J.M. (1961). *Theory of elastic stability* (2nd edition). McGraw-Hill: New York.

Timoshenko, S.P., and Goodier, J.N. (1970). *Theory of elasticity* (3rd edition). McGraw-Hill: New York.

Timoshenko, S.P., and Young, D.H. (1963). *Vibration problems in engineering*. John Wiley and Sons.: New York.

Touratier, M. (1991). An efficient standard plate theory. *International Journal of Engineering Science. 29*(8), 901-916. https://doi.org/10.1016/0020-7225(91)90165-Y

Tran, L.V., Wahab, M.A., and Kim, S.E. (2017). An iso-geometric finite element approach for thermal bending and buckling analyses of laminated composite plates. *Journal of Composite Structures, 179*(2), 35 – 49. https://doi.org/10.1016/j.compstruct.2017.07.056

Truesdell, C. (1968). *Essays in the history of mechanics.* Springer-Verlag: Berlin.

Ugural, A. C. (1999). *Stresses in plates and shells* (2nd edition). McGraw-hill: Singapore

Vaghefi, R., Baradaran, G. H., and Koohkan, H. (2010). Three-dimensional static analysis of thick functionally graded plates by using meshless local petro-Galerkin (MLPG) method. *Journal of Engineering Analysis with Boundary Elements, 34*(6), 564 – 573. https://doi.org/10.1016/j.enganabound.2010.01.005

Vasiliev, V. V., and Morozov, E. (2013). *Advanced mechanics of composite materials and structural elements* (third Edition). Elsevier: London

Ventsel, E., and Krauthammer, T. (2001). *Thin plates and shells: Theory, analysis and applications.* Marcel Dekker: New York

Venkatesan, S., and Kunukkaseril, V. X. (1978). Free vibrations of layered circular plates. *Journal of Sound and Vibration, 60*(4), 511-534. https://doi.org/10.1016/S0022-460X(78)80089-3

Versino, D., Gherlone, M., Mattone, M., DiSciuva, M., and Tessler, A. (2013). C0 triangular elements based on their fined zig-zag theory for multilayer composite and sandwich plates. *Journal of Composites Part B Engineering, 44*(1), 218– 230. https://doi.org/10.1016/j.compositesb.2012.05.026

Viswanathan, K. K., Javed, S., and Aziz, Z. A. (2015). Free vibration of symmetric angle ply laminated annular circular plate of variable thickness under shear deformation theory. *International Journal of Theoretical and Applied Mchanics, Meccanica, 50*(12), 3013 – 3027. https://doi.org/10.1007/s11012-015-0175-3

Volmir, A.S. (1974). *The nonlinear dynamics of plates and shells* (Edited translation). Mono. Nelineinaya Dinamika Plastinok I Obolochek: Moscow

Wang, C. M., and Aung, T. M. (2007). Plastic buckling of thick plates using p-Ritz method. *Internation Journal of Solids and Structures, 44*(18-19), 6239 – 6255. https://doi.org/10.1016/j.ijsolstr.2007.02.026

Wang, C. M., Tan, T, J., Hong, G. M., and Alwis, W. A. M. (1996). Buckling of tapered circular plates: Allowances for effects of shear and radial deformation. *Mechanics of Structures and Machines, 24*(2), 135-153. https://doi.org/10.1080/08905459608905259

Wang, C. M., Xiang, Y., and Chakrabarty, J. (2001). Elastic/plastic buckling of thick plates. *International Journal of Solids and Structures, 38*(1), 8617-8640. https://doi.org/10.1016/S0020-7683(01)00144-5

Wang, D., Dong, S.B., and Chen, J.S. (2006). Extended mesh free analysis of transverse and in-plane loading of a laminated anisotropic plate of general plan-form geometry. *International Journal of Solids and Structures, 43*(1), 144 – 171. https://doi.org/10.1016/j.ijsolstr.2005.03.068

Wang, X. (2017). Free vibration analysis of angle-ply symmetric laminated plates with free boundary conditions by the discrete singular convolution, *Journal of Composite Structures, 170*(1), 91 – 102. https://doi.org/10.1016/j.compstruct.2017.02.089

Wesolowski, M., and Barkanov, E. (2016). Air damping influence on dynamic parameters of laminated composite plates. *Journal of Measurement, 85*(1), 239 – 248. https://doi.org/10.1016/j.measurement.2016.02.036

Whitney, J. M. (1973). Shear correction factors for orthotropic laminates under static load. *Journal of Applied Mechanics, 40*(1), 302 - 304. https://doi.org/10.1115/1.3422950

Whitney, J. M., and Pagano, N. (1970). Shear deformation in heterogeneous anisotropic plate. *Journal of Applied Mechanics, 37*(1), 1031 – 1036. https://doi.org/10.1115/1.34085654

Whitney, J. M., and Sun, C. T. (1973). A higher order theory for extensional motion of laminated composites. *Journal of Sound and Vibration, 30*(1), 85 -97. https://doi.org/10.1016/S0022-460X(73)80052-5

Wu, C. P., and Hsu, C. S. (1993). A new local higher order laminated theory. *Journal of Composite Structures, 25*(1), 439 – 448. https://doi.org/10.1016/0263-8223(93)90191-R

Wu, T. Y., and Liu, G. R. (2001). Free vibration analysis of circular plates with variable thickness by the generalized differential quadrature rule. *International Journal of Solids and Structures, 38*(44-45), 7967-7980. https://doi.org/10.1016/S0020-7683(01)00077-4

Xiang, Y. (2002). Exact vibration solutions for circular Mindlin plates with multiple concentric ring supports. *Journal of Solids and Structures, 39*(25), 6081–6102. https://doi.org/10.1016/S0020-7683(02)00494-8

Xie, J., Waas, A.M., and Rassaian, M. (2017). Analytical predictions of delamination threshold Load of laminated composite plates subject to flexural loading. *Journal of Composite Structures, 179*(2), 181 – 194. https://doi.org/10.1016/j.compstruct.2017.07.009

Yahia, S.A., Atmane, H.A., Houari, M.S.A., and Tounsi, A. (2015). Wave propagation in Functionally graded plates with porosities using various higher-order shear deformation plate theories. *Journal of Structural Engineering Mechanics, 53*(6), 1143– 1165. https://doi.org/10.12989/sem.2015.53.6.1143

Yang, C.S., and Oyadiji, O. (2017). Delamination detection in composite laminate plates using 2D wavelet analysis of modal frequency surface. *Journal of Computers and Structures, 179*(1), 109 – 126. https://doi.org/10.1016/j.compstruc.2016.10.019

Yang, W., and He D. (2018). Bending, free vibration and buckling analyses of anisotropic layered micro-plates based on a new size dependent model. *Journal of Composite Structures, 189*(1), 137 – 147. https://doi.org/10.1016/j.compstruct.2017.09.057

Zenkour, A. M. (2013). A simple four-unknown refined theory for bending analysis of Functionally graded plates. *Applied Mathematical Modelling, 37*(20-21), 9041 -9051. https://doi.org/10.1016/j.apm.2013.04.022

Zhanga, H., Shia, D., and Wangb, Q. (2017). An improved Fourier series solution for free vibration analysis of the moderately thick laminated composite rectangular plate with non-uniform boundary conditions. *International Journal of Mechanical Science, 121*(11), 1 – 20. https://doi.org/10.1016/j.ijmecsci.2016.12.007

Zhen-qiang, C., Xiu:xi, W., and Mao-guang, H. (1994). Post-buckling behavior of rectangular moderately thick plates and sandwich plates. *Applied Mathematics and Mechanics (English Edition), 15*(7), 605 - 610. https://doi.org/10.1007/BF02451609

APPENDIX A

Example problem of typical anisotropic rectangular thick plate (SSSS boundary condition)

Analyze an orthotropic thick square SSSS plate with the following information:
$E_1 = 25$; $E_2 = 1$; $G_{12} = 0.5$; $G_{13} = 0.5$; $G_{23} = 0.2$, $\mu_{12} = 0.25$ (from section 3.6).
Solution

$$h = (R - 2R^3 + R^4)(Q - 2Q^3 + Q^4) \quad \text{A1}$$

$$H = S - \frac{4}{3}S^3 \quad \text{A2}$$

$$E_0 = E_2 = 1 \quad \text{A3}$$

$$g_2 = \frac{4}{5};\ \ g_3 = \frac{68}{105};\ g_4 = 6.4;\quad \mu_{21} = \mu_2 = \frac{E_2}{E_1}\mu_{12} = 0.01; \quad \text{A4}$$

$$E_{11} = E_1 \ \ and\ d_{11} = \frac{E_{11}}{E_0} = \frac{E_{11}}{1} = 25 \quad \text{A5}$$

$$E_{12} = E_2 \,.\mu_{12} \ \ and\ d_{12} = \frac{E_{12}}{E_0} = \frac{E_2 \,.\mu_{12}}{1} = \frac{1\times 0.25}{1} = 0.25 \quad \text{A6}$$

$$E_{21} = E_1 \,.\mu_{21} \ and\ d_{21} = \frac{E_{21}}{E_0} = \frac{E_1 \,.\mu_{21}}{1} = \frac{25 \times 0.01}{E_0} = 0.25 \quad \text{A7}$$

$$E_{22} = E_2 \ \ and\ d_{22} = \frac{E_{22}}{E_0} = \frac{1}{1} = 1 \quad \text{A8}$$

$$E_{33} = G_{12}(1 - \mu_{12}\mu_{21}) \quad and\ d_{33} = \frac{E_{33}}{E_0} = \frac{G_{12}(1-\mu_{12}\mu_{21})}{1} = \frac{0.5\times(1-0.25\times 0.01)}{1} = 0.49875 \quad \text{A9}$$

$$E_{44} = G_{13}(1 - \mu_{12}\mu_{21}) \quad and\ d_{44} = \frac{E_{44}}{E_0} = \frac{G_{13}(1-\mu_{12}\mu_{21})}{1} = \frac{0.5\times(1-0.25\times 0.01)}{1} = 0.49875 \quad \text{A10}$$

$$E_{55} = G_{23}(1 - \mu_{12}\mu_{21}) \ and\ d_{55} = \frac{E_{55}}{E_0} = \frac{G_{23}(1-\mu_{12}\mu_{21})}{1} = \frac{0.2\times(1-0.25\times 0.01)}{1} = 0.1995 \quad \text{A11}$$

Constitutive relations

Angle of orientation $\theta = \mathbf{0^o}$

$$B_{11} = m^4 d_{11} + 2m^2n^2(d_{12} + 2d_{33}) + n^4 d_{22} = 25 \quad \text{A12}$$

$$B_{12} = d_{12}(n^4 + m^4) + m^2n^2(d_{11} + d_{22} - 4d_{33}) = 0.25 \quad \text{A13}$$

$$B_{13} = m^3n(d_{11} - d_{12} - 2d_{33}) + mn^3(d_{12} - d_{22} + 2d_{33}) = 0 \quad \text{A14}$$

$$B_{22} = n^4 d_{11} + 2m^2n^2(d_{12} + 2d_{33}) + m^4 d_{22} = 1 \quad \text{A15}$$

$$B_{23} = mn^3 d_{11} - m^3n d_{22} + (m^3n - mn^3)(d_{12} + 2d_{33}) = 0 \quad \text{A16}$$

$B_{33} = m^2n^2(d_{11} - 2d_{12} + d_{22} - 2d_{33}) + d_{33}(m^4 + n^4) \;\; = 0.49875$ A17

$B_{21} = B_{12},\; B_{31} = B_{13} \;\; and \;\; B_{32} = B_{23}$ A18

$B_{44} = d_{44} \;\; = 0.49875$ A19

$B_{55} = d_{55} \;\;\; = 0.1995$ A20

$k_1 = 0.236190476; k_2 = 0.235918; \;\; k_3 = 0.236190476; k_4 = 0; k_5 = 0; k_6 = 0.0239; k_7 = 0.0239; k_8 = 0.04$ A21

For square plate, β = 1, a/t = 5, θ = $\mathbf{0^o}$

$L_{11} = g_3\mathrm{B}_{11}k_1 + \frac{\mathrm{B}_{33}}{\beta^2}g_3k_2 + 2\frac{B_{13}}{\beta}g_3k_4 + \mathrm{B}_{44}.\left(\frac{a}{t}\right)^2.g_4.k_6 \;\; = \;\; 5.807476009$ A22

$L_{12} = (\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_3}{\beta^2}k_2 + \frac{B_{13}}{\beta}g_3k_4 + \frac{B_{23}}{\beta^3}g_3k_5 \;\; = \;\; 0.11439794$ A23

$L_{13} = (\mathrm{B}_{11} + 0.5\mathrm{B}_{12})g_2k_1 + (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2}k_2 + 3\frac{B_{13}}{\beta}g_2k_4 + \frac{B_{23}}{\beta^3}g_2k_5 \;\; = 4.865151837$ A24

$L_{21} = (\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_3}{\beta^2}.k_2 + \frac{B_{13}}{\beta}g_3k_4 + \frac{B_{23}}{\beta^3}g_3k_5 \;\; = \;\; 0.11439794$ A25

$L_{22} = \frac{\mathrm{B}_{22}}{\beta^4}g_3k_3 + 2\frac{B_{23}}{\beta^3}g_3k_5 + \frac{\mathrm{B}_{33}}{\beta^2}g_3k_2 + \frac{\mathrm{B}_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2.g_4k_7 \;\; = \;\; 0.992058322$ A26

$L_{23} = (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2}k_2 + (0.5\mathrm{B}_{12} + \mathrm{B}_{22})\frac{g_2}{\beta^4}k_3 + \frac{B_{13}}{\beta}g_2k_4 + 3\frac{B_{23}}{\beta^3}g_2k_5 \;\; = \;\; 0.330294694$ A27

$L_{31} = (\mathrm{B}_{11} + 0.5\mathrm{B}_{12})g_2k_1 + (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2}k_2 + 3\frac{B_{13}}{\beta}g_2k_4 + \frac{B_{23}}{\beta^3}g_2k_5 \;\; = 4.865151837$ A28

$L_{32} = (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2}k_2 + (0.5\mathrm{B}_{12} + \mathrm{B}_{22})\frac{g_2}{\beta^4}k_3 + \frac{B_{13}}{\beta}g_2k_4 + 3\frac{B_{23}}{\beta^3}g_2k_5 \;\; = \;\; 0.330294694$ A29

$\mathrm{P}_2 = \frac{(L_{12}.L_{23} - L_{13}.L_{22})}{({L_{12}}^2 - L_{11}L_{22})} \;\; = \;\; 0.833073427$ A30

$\mathrm{P}_3 = \frac{(L_{12}.L_{13} - L_{11}L_{23})}{({L_{12}}^2 - L_{11}L_{22})} \;\; = \;\; 0.236873987$ A31

$k_{T1} = [\mathrm{B}_{11} - \mathrm{B}_{11}g_2\mathrm{P}_2 - 0.5\mathrm{B}_{12}g_2\mathrm{P}_2]k_1 \;\; = \;\; 1.949805316$ A32

$k_{T2} \;=\; \frac{1}{2\beta^2}(2\mathrm{B}_{33} + \mathrm{B}_{12})[4 - g_2\mathrm{P}_2 - g_2\mathrm{P}_3]k_2 \;\; = \;\; 0.462658623$ A33

$k_{T3} = \;\; \frac{1}{\beta^4}[\mathrm{B}_{22} - \mathrm{B}_{22}g_2\mathrm{P}_3 - 0.5\mathrm{B}_{12}g_2\mathrm{P}_3]k_3 \;\; = \;\; 0.185837834$ A34

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2\mathrm{P}_2 - g_2\mathrm{P}_3]k_4 \quad = \quad 0 \qquad \text{A35}$$

$$k_{T5} = \frac{B_{23}}{\beta^3}.[4 - g_2\mathrm{P}_2 - 3g_2\mathrm{P}_3]k_5 \quad = \quad 0 \qquad \text{A36}$$

$$k_T = [\mathrm{B}_{11} - \mathrm{B}_{11}g_2\mathrm{P}_2 - 0.5\mathrm{B}_{12}g_2\mathrm{P}_2]k_1 + \frac{1}{2\beta^2}(2\mathrm{B}_{33} + \mathrm{B}_{12})[4 - g_2\mathrm{P}_2 - g_2\mathrm{P}_3]k_2 +$$
$$\frac{1}{\beta^4}[\mathrm{B}_{22} - \mathrm{B}_{22}g_2\mathrm{P}_3 - 0.5\mathrm{B}_{12}g_2\mathrm{P}_3]k_3 + \frac{B_{13}}{\beta}[4 - 3g_2\mathrm{P}_2 - g_2\mathrm{P}_3]k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2\mathrm{P}_2 - 3g_2\mathrm{P}_3]k_5 =$$
$$k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = 2.598301773 \qquad \text{A37}$$

$$\mathrm{A}_1 = \left(\frac{k_8}{k_T}\right)\frac{\mathrm{q}a^4}{\mathrm{D}_0} \quad = \quad 0.015394671\,.\frac{\mathrm{q}a^4}{\mathrm{D}_0} \qquad \text{A38}$$

$$\phi_\mathrm{x} = \left(\frac{\mathrm{k}_8}{\mathrm{k}_\mathrm{T}}\right)\mathrm{P}_2.\frac{\partial \mathrm{h}}{\partial \mathrm{R}}.\frac{\mathrm{qa}^3}{\mathrm{D}_0} \quad = \quad 0.004007778\,.\frac{\mathrm{q}a^3}{\mathrm{D}_0} \qquad \text{A39}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{\mathrm{P}_3}{\beta}.\frac{\partial \mathrm{h}}{\partial Q}\;\frac{\mathrm{q}a^3}{\mathrm{D}_0} \quad = \quad 0.001139562\,.\frac{\mathrm{q}a^3}{\mathrm{D}_0} \qquad \text{A40}$$

$$\mathrm{w} = \left(\frac{k_8}{k_T}\right)\mathrm{h}\,.\frac{12[1-\mu_{xy}\mu_{yx}]\mathrm{q}a^4}{\mathrm{E}_0\mathrm{t}^3} \quad = \quad 0.017995528\,.\;\frac{\mathrm{q}a^4}{\mathrm{E}_0\mathrm{t}^3} \qquad \text{A41}$$

$$\text{Where } \mathrm{D}_0 = \quad \frac{\mathrm{E}_0\mathrm{t}^3}{12[1-\mu_{xy}\mu_{yx}]} \qquad \text{A42}$$

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{\mathrm{a}}{\mathrm{t}}\right)^2\left[\mathrm{P}_2 - \frac{4}{3}\,\mathrm{P}_2\,S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial \mathrm{h}}{\partial R}.\frac{\mathrm{qa}}{\mathrm{E}_0} \quad = \quad -0.320045223\,.\frac{\mathrm{q}a^3}{\mathrm{E}_0\mathrm{t}^2} \qquad \text{A43}$$

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{\mathrm{a}}{\mathrm{t}}\right)^2\left[\mathrm{P}_3 - \frac{4}{3}\mathrm{P}_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial \mathrm{h}}{\partial Q}.\frac{\mathrm{qa}}{\mathrm{E}_0} \quad = \quad -0.606149857\,.\frac{\mathrm{q}a^3}{\mathrm{E}_0\mathrm{t}^2} \qquad \text{A44}$$

$$\sigma_\mathrm{R} = 12\mathrm{qS}.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(\mathrm{B}_{11}.\left[\mathrm{P}_2 - \frac{4}{3}\mathrm{P}_2S^2 - 1\right].\frac{\partial^2\mathrm{h}}{\partial R^2} + \frac{\mathrm{B}_{12}}{\beta^2}.\left[\mathrm{P}_3 - \frac{4}{3}\mathrm{P}_3S^2 - 1\right].\frac{\partial^2\mathrm{h}}{\partial Q^2} +$$
$$\frac{B_{13}}{\beta}.\left[\mathrm{P}_2 + \mathrm{P}_3 - \frac{4}{3}\mathrm{P}_2S^2 - \frac{4}{3}\mathrm{P}_3S^2 - 2\right].\frac{\partial^2\mathrm{h}}{\partial \mathrm{R}\partial Q}\Big) \quad = \quad 0.980772095\,.\frac{\mathrm{q}a^2}{\mathrm{E}_0\mathrm{t}^2} \qquad \text{A45}$$

$$\sigma_\mathrm{Q} = 12\mathrm{qS}.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(\mathrm{B}_{21}.\left[\mathrm{P}_2 - \frac{4}{3}\mathrm{P}_2S^2 - 1\right].\frac{\partial^2\mathrm{h}}{\partial R^2} + \frac{\mathrm{B}_{22}}{\beta^2}.\left[\mathrm{P}_3 - \frac{4}{3}\mathrm{P}_3S^2 - 1\right].\frac{\partial^2\mathrm{h}}{\partial Q^2} +$$
$$\frac{B_{23}}{\beta}.\left[\mathrm{P}_2 + \mathrm{P}_3 - \frac{4}{3}\mathrm{P}_2S^2 - \frac{4}{3}\mathrm{P}_3S^2 - 2\right].\frac{\partial^2\mathrm{h}}{\partial \mathrm{R}\partial Q}\Big) \quad = \quad 0.036454463\,.\frac{\mathrm{q}a^2}{\mathrm{E}_0\mathrm{t}^2} \qquad \text{A46}$$

$$\tau_\mathrm{RQ} = 12\mathrm{qS}.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(\mathrm{B}_{31}.\left[\mathrm{P}_2 - \frac{4}{3}\mathrm{P}_2S^2 - 1\right].\frac{\partial^2\mathrm{h}}{\partial R^2} + \frac{\mathrm{B}_{32}}{\beta^2}.\left[\mathrm{P}_3 - \frac{4}{3}\mathrm{P}_3S^2 - 1\right].\frac{\partial^2\mathrm{h}}{\partial Q^2} +$$
$$\frac{B_{33}}{\beta}.\left[\mathrm{P}_2 + \mathrm{P}_3 - \frac{4}{3}\mathrm{P}_2S^2 - \frac{4}{3}\mathrm{P}_3S^2 - 2\right].\frac{\partial^2\mathrm{h}}{\partial \mathrm{R}\partial Q}\Big) \quad = \quad 0.059276485\,.\frac{\mathrm{q}a^2}{\mathrm{E}_0\mathrm{t}^2} \qquad \text{A47}$$

$$\tau_\mathrm{RS} = 12\mathrm{q}\left(\frac{\mathrm{a}}{\mathrm{t}}\right)^3\mathrm{B}_{44}(\mathrm{P}_2 - 4\mathrm{P}_2S^2).\left(\frac{\mathrm{k}_8}{\mathrm{k}_\mathrm{T}}\right).\frac{\partial \mathrm{h}}{\partial \mathrm{R}} \quad = \quad 0.59966385\,.\frac{\mathrm{q}a}{\mathrm{E}_0\mathrm{t}} \qquad \text{A48}$$

$$\tau_\mathrm{QS} = 12\mathrm{q}\left(\frac{\mathrm{a}}{\mathrm{t}}\right)^3\frac{\mathrm{B}_{55}}{\beta}(\mathrm{P}_3 - 4\mathrm{P}_3S^2).\left(\frac{\mathrm{k}_8}{\mathrm{k}_\mathrm{T}}\right).\frac{\partial \mathrm{h}}{\partial Q} \quad = \quad 0.06820276\,.\frac{\mathrm{q}a}{\mathrm{E}_0\mathrm{t}} \qquad \text{A49}$$

For square plate, $\beta = 1$, $a/t = 10$, $\theta = \mathbf{0^o}$

$$L_{11} = g_3 \mathrm{B}_{11} k_1 + \frac{\mathrm{B}_{33}}{\beta^2} g_3 k_2 + 2\frac{B_{13}}{\beta} g_3 k_4 + \mathrm{B}_{44}.\left(\frac{a}{t}\right)^2 . g_4 . k_6 \quad = \quad 11.52919029 \qquad \text{A50}$$

$$L_{12} = (\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_3}{\beta^2} k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 \quad = \quad 0.11439794 \qquad \text{A51}$$

$$L_{13} = (\mathrm{B}_{11} + 0.5\mathrm{B}_{12}) g_2 k_1 + (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2} k_2 + 3\frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 \;=\; 4.865151837 \qquad \text{A52}$$

$$L_{21} = (\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_3}{\beta^2} . k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 \quad = \; 0.11439794 \qquad \text{A53}$$

$$L_{22} = \frac{\mathrm{B}_{22}}{\beta^4} g_3 k_3 + 2\frac{B_{23}}{\beta^3} g_3 k_5 + \frac{\mathrm{B}_{33}}{\beta^2} g_3 k_2 + \frac{\mathrm{B}_{55}}{\beta^2} . \left(\frac{a}{t}\right)^2 . g_4 k_7 \quad = 3.280744036 \qquad \text{A54}$$

$$L_{23} = (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2} k_2 + (0.5\mathrm{B}_{12} + \mathrm{B}_{22})\frac{g_2}{\beta^4} k_3 + \frac{B_{13}}{\beta} g_2 k_4 + 3\frac{B_{23}}{\beta^3} g_2 k_5 \;=\; 0.330294694 \qquad \text{A55}$$

$$L_{31} = (\mathrm{B}_{11} + 0.5\mathrm{B}_{12}) g_2 k_1 + (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2} k_2 + 3\frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 \;=\; 4.865151837 \qquad \text{A56}$$

$$L_{32} = (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2} k_2 + (0.5\mathrm{B}_{12} + \mathrm{B}_{22})\frac{g_2}{\beta^4} k_3 + \frac{B_{13}}{\beta} g_2 k_4 + 3\frac{B_{23}}{\beta^3} g_2 k_5 \;=\; 0.330294694 \qquad \text{A57}$$

$$\mathrm{P}_2 = \frac{(L_{12}.L_{23} - L_{13}.L_{22})}{({L_{12}}^2 - L_{11}L_{22})} \quad = \quad 0.421132308 \qquad \text{A58}$$

$$\mathrm{P}_3 = \frac{(L_{12}.L_{13} - L_{11}L_{23})}{({L_{12}}^2 - L_{11}L_{22})} \quad = \quad 0.085992087 \qquad \text{A59}$$

$$k_{T1} = [\mathrm{B}_{11} - \mathrm{B}_{11} g_2 \mathrm{P}_2 - 0.5\mathrm{B}_{12} g_2 \mathrm{P}_2] k_1 \quad = \; 3.905466353 \qquad \text{A60}$$

$$k_{T2} = \frac{1}{2\beta^2}(2\mathrm{B}_{33} + \mathrm{B}_{12})[4 - g_2\mathrm{P}_2 - g_2\mathrm{P}_3] k_2 \;=\; 0.528915987 \qquad \text{A61}$$

$$k_{T3} = \frac{1}{\beta^4}[\mathrm{B}_{22} - \mathrm{B}_{22} g_2 \mathrm{P}_3 - 0.5\mathrm{B}_{12} g_2 \mathrm{P}_3] k_3 \quad = \; 0.217911015 \qquad \text{A62}$$

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2\mathrm{P}_2 - g_2\mathrm{P}_3] k_4 \quad = \quad 0 \qquad \text{A63}$$

$$k_{T5} = \frac{B_{23}}{\beta^3} . [4 - g_2\mathrm{P}_2 - 3g_2\mathrm{P}_3] k_5 \quad = \quad 0 \qquad \text{A64}$$

$$k_T = [\mathrm{B}_{11} - \mathrm{B}_{11} g_2 \mathrm{P}_2 - 0.5\mathrm{B}_{12} g_2 \mathrm{P}_2] k_1 + \frac{1}{2\beta^2}(2\mathrm{B}_{33} + \mathrm{B}_{12})[4 - g_2\mathrm{P}_2 - g_2\mathrm{P}_3] k_2 +$$
$$\frac{1}{\beta^4}[\mathrm{B}_{22} - \mathrm{B}_{22} g_2 \mathrm{P}_3 - 0.5\mathrm{B}_{12} g_2 \mathrm{P}_3] k_3 + \frac{B_{13}}{\beta}[4 - 3g_2\mathrm{P}_2 - g_2\mathrm{P}_3] k_4 + \frac{B_{23}}{\beta^3} . [4 - g_2\mathrm{P}_2 - 3g_2\mathrm{P}_3] k_5 =$$
$$k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = \; 4.652293355 \qquad \text{A65}$$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.00859791.\frac{qa^4}{D_0} \qquad A66$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 0.001131518.\frac{qa^3}{D_0} \qquad A67$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 0.000231048.\frac{qa^3}{D_0} \qquad A68$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.010050487.\frac{qa^4}{E_0t^3} \qquad A69$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -1.156602175.\frac{qa^3}{E_0t^2} \qquad A70$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -1.515889891.\frac{qa^3}{E_0t^2} \qquad A71$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.881023364.\frac{qa^2}{E_0t^2} \qquad A72$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.025987129.\frac{qa^2}{E_0t^2} \qquad A73$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.042759873.\frac{qa^2}{E_0t^2} \qquad A74$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.677213546.\frac{qa}{E_0t} \qquad A75$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.055312789.\frac{qa}{E_0t} \qquad A76$$

For square plate, $\beta = 1$, $a/t = 20$, $\theta = \mathbf{0^o}$

$$L_{11} = g_3B_{11}k_1 + \frac{B_{33}}{\beta^2}g_3k_2 + 2\frac{B_{13}}{\beta}g_3k_4 + B_{44}.\left(\frac{a}{t}\right)^2.g_4.k_6 \quad = \quad 34.41604744 \qquad A77$$

$$L_{12} = (B_{12} + B_{33})\frac{g_3}{\beta^2}k_2 + \frac{B_{13}}{\beta}g_3k_4 + \frac{B_{23}}{\beta^3}g_3k_5 \quad = \quad 0.11439794 \qquad A78$$

$$L_{13} = (B_{11} + 0.5B_{12})g_2k_1 + (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + 3\frac{B_{13}}{\beta}g_2k_4 + \frac{B_{23}}{\beta^3}g_2k_5 \quad = 4.865151837 \qquad A79$$

$$L_{21} = (B_{12} + B_{33})\frac{g_3}{\beta^2}.k_2 + \frac{B_{13}}{\beta}g_3k_4 + \frac{B_{23}}{\beta^3}g_3k_5 \quad = \quad 0.11439794 \qquad A80$$

$$L_{22} = \frac{B_{22}}{\beta^4} g_3 k_3 + 2\frac{B_{23}}{\beta^3} g_3 k_5 + \frac{B_{33}}{\beta^2} g_3 k_2 + \frac{B_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2.g_4 k_7 \quad = 12.43548689 \qquad \text{A81}$$

$$L_{23} = (0.5B_{12} + B_{33})\frac{g_2}{\beta^2} k_2 + (0.5B_{12} + B_{22})\frac{g_2}{\beta^4} k_3 + \frac{B_{13}}{\beta} g_2 k_4 + 3\frac{B_{23}}{\beta^3} g_2 k_5 \quad = 0.330294694 \qquad \text{A82}$$

$$L_{31} = (B_{11} + 0.5B_{12}) g_2 k_1 + (0.5B_{12} + B_{33})\frac{g_2}{\beta^2} k_2 + 3\frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 \quad = 4.865151837 \qquad \text{A83}$$

$$L_{32} = (0.5B_{12} + B_{33})\frac{g_2}{\beta^2} k_2 + (0.5B_{12} + B_{22})\frac{g_2}{\beta^4} k_3 + \frac{B_{13}}{\beta} g_2 k_4 + 3\frac{B_{23}}{\beta^3} g_2 k_5 \quad = 0.330294694 \qquad \text{A84}$$

$$P_2 = \frac{(L_{12}.L_{23} - L_{13}.L_{22})}{({L_{12}}^2 - L_{11}L_{22})} \quad = \quad 0.141278921 \qquad \text{A85}$$

$$P_3 = \frac{(L_{12}.L_{13} - L_{11}L_{23})}{({L_{12}}^2 - L_{11}L_{22})} \quad = \quad 0.025260987 \qquad \text{A86}$$

$$k_{T1} = [B_{11} - B_{11} g_2 P_2 - 0.5B_{12} g_2 P_2] k_1 \quad = \quad 5.234050321 \qquad \text{A87}$$

$$k_{T2} = \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2 P_2 - g_2 P_3] k_2 = 0.569010705 \qquad \text{A88}$$

$$k_{T3} = \frac{1}{\beta^4}[B_{22} - B_{22} g_2 P_3 - 0.5B_{12} g_2 P_3] k_3 \quad = 0.230820712 \qquad \text{A89}$$

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2 P_2 - g_2 P_3] k_4 \quad = \quad 0 \qquad \text{A90}$$

$$k_{T5} = \frac{B_{23}}{\beta^3}.[4 - g_2 P_2 - 3g_2 P_3] k_5 \quad = \quad 0 \qquad \text{A91}$$

$$k_T = [B_{11} - B_{11} g_2 P_2 - 0.5B_{12} g_2 P_2] k_1 + \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2 P_2 - g_2 P_3] k_2 +$$
$$\frac{1}{\beta^4}[B_{22} - B_{22} g_2 P_3 - 0.5B_{12} g_2 P_3] k_3 + \frac{B_{13}}{\beta}[4 - 3g_2 P_2 - g_2 P_3] k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2 P_2 - 3g_2 P_3] k_5 =$$
$$k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = 6.033881738 \qquad \text{A92}$$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.006629232.\frac{qa^4}{D_0} \qquad \text{A93}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 0.000292678.\frac{qa^3}{D_0} \qquad \text{A94}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 5.23315E-05.\frac{qa^3}{D_0} \qquad \text{A95}$$

$$w = \left(\frac{k_8}{k_T}\right) h.\frac{12[1 - \mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = \quad 0.007749209.\frac{qa^4}{E_0 t^3} \qquad \text{A96}$$

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -4.49237932.\frac{qa^3}{E_0 t^2} \qquad \text{A97}$$

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -4.875972812.\frac{qa^3}{E_0 t^2} \qquad \text{A98}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.853597565.\frac{qa^2}{E_0t^2} \quad A99$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.022270508.\frac{qa^2}{E_0t^2} \quad A100$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.037473409.\frac{qa^2}{E_0t^2} \quad A101$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.700671952.\frac{qa}{E_0t} \quad A102$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.050112686.\frac{qa}{E_0t} \quad A103$$

For square plate, $\beta = 1$, $a/t = 30$, $\theta = \mathbf{0^o}$

$$L_{11} = g_3B_{11}k_1 + \frac{B_{33}}{\beta^2}g_3k_2 + 2\frac{B_{13}}{\beta}g_3k_4 + B_{44}.\left(\frac{a}{t}\right)^2.g_4.k_6 = 72.56080934 \quad A104$$

$$L_{12} = (B_{12} + B_{33})\frac{g_3}{\beta^2}k_2 + \frac{B_{13}}{\beta}g_3k_4 + \frac{B_{23}}{\beta^3}g_3k_5 = 0.11439794 \quad A105$$

$$L_{13} = (B_{11} + 0.5B_{12})g_2k_1 + (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + 3\frac{B_{13}}{\beta}g_2k_4 + \frac{B_{23}}{\beta^3}g_2k_5 = 4.865151837 \quad A106$$

$$L_{21} = (B_{12} + B_{33})\frac{g_3}{\beta^2}.k_2 + \frac{B_{13}}{\beta}g_3k_4 + \frac{B_{23}}{\beta^3}g_3k_5 = 0.11439794 \quad A107$$

$$L_{22} = \frac{B_{22}}{\beta^4}g_3k_3 + 2\frac{B_{23}}{\beta^3}g_3k_5 + \frac{B_{33}}{\beta^2}g_3k_2 + \frac{B_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2.g_4k_7 = 27.69339166 \quad A108$$

$$L_{23} = (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + (0.5B_{12} + B_{22})\frac{g_2}{\beta^4}k_3 + \frac{B_{13}}{\beta}g_2k_4 + 3\frac{B_{23}}{\beta^3}g_2k_5 = 0.330294694 \quad A109$$

$$L_{31} = (B_{11} + 0.5B_{12})g_2k_1 + (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + 3\frac{B_{13}}{\beta}g_2k_4 + \frac{B_{23}}{\beta^3}g_2k_5 = 4.865151837 \quad A110$$

$$L_{32} = (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + (0.5B_{12} + B_{22})\frac{g_2}{\beta^4}k_3 + \frac{B_{13}}{\beta}g_2k_4 + 3\frac{B_{23}}{\beta^3}g_2k_5 = 0.330294694 \quad A111$$

$$P_2 = \frac{(L_{12}.L_{23} - L_{13}.L_{22})}{(L_{12}{}^2 - L_{11}L_{22})} = 0.067030938 \quad A112$$

$$P_3 = \frac{(L_{12}.L_{13} - L_{11}L_{23})}{(L_{12}{}^2 - L_{11}L_{22})} \quad = \quad 0.011649945 \qquad \text{A113}$$

$$k_{T1} = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 \quad = \quad 5.586537315 \qquad \text{A114}$$

$$k_{T2} = \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 = 0.579353756 \qquad \text{A115}$$

$$k_{T3} = \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 \quad = 0.233714031 \qquad \text{A116}$$

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 \quad = \quad 0 \qquad \text{A117}$$

$$k_{T5} = \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 \quad = \quad 0 \qquad \text{A118}$$

$$k_T = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 + \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 + \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 + \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 = k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = 6.399605102 \qquad \text{A119}$$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.006250386.\frac{qa^4}{D_0} \qquad \text{A120}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 0.000130928.\frac{qa^3}{D_0} \qquad \text{A121}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 2.27552E-05.\frac{qa^3}{D_0} \qquad \text{A122}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1 - \mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.007306359.\frac{qa^4}{E_0t^3} \qquad \text{A123}$$

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -10.05099498.\frac{qa^3}{E_0t^2} \qquad \text{A124}$$

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -10.43944306.\frac{qa^3}{E_0t^2} \qquad \text{A125}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.84840346.\frac{qa^2}{E_0t^2} \qquad \text{A126}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.021516243.\frac{qa^2}{E_0t^2} \qquad \text{A127}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.036427445.\frac{qa^2}{E_0t^2} \qquad \text{A128}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.705243022.\frac{qa}{E_0t} \qquad \text{A129}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.050112686.\frac{qa}{E_0t} \qquad \text{A130}$$

For square plate, $\beta = 1$, $a/t = 40$, $\theta = \mathbf{0^o}$

$$L_{11} = g_3B_{11}k_1 + \frac{B_{33}}{\beta^2}g_3k_2 + 2\frac{B_{13}}{\beta}g_3k_4 + B_{44}.\left(\frac{a}{t}\right)^2.g_4.k_6 = 125.963476 \qquad \text{A131}$$

$$L_{12} = (B_{12} + B_{33})\frac{g_3}{\beta^2}k_2 + \frac{B_{13}}{\beta}g_3k_4 + \frac{B_{23}}{\beta^3}g_3k_5 = 0.11439794 \qquad \text{A132}$$

$$L_{13} = (B_{11} + 0.5B_{12})g_2k_1 + (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + 3\frac{B_{13}}{\beta}g_2k_4 + \frac{B_{23}}{\beta^3}g_2k_5 = 4.865151837 \qquad \text{A133}$$

$$L_{21} = (B_{12} + B_{33})\frac{g_3}{\beta^2}.k_2 + \frac{B_{13}}{\beta}g_3k_4 + \frac{B_{23}}{\beta^3}g_3k_5 = 0.11439794 \qquad \text{A134}$$

$$L_{22} = \frac{B_{22}}{\beta^4}g_3k_3 + 2\frac{B_{23}}{\beta^3}g_3k_5 + \frac{B_{33}}{\beta^2}g_3k_2 + \frac{B_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2.g_4k_7 = 49.05445832 \qquad \text{A135}$$

$$L_{23} = (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + (0.5B_{12} + B_{22})\frac{g_2}{\beta^4}k_3 + \frac{B_{13}}{\beta}g_2k_4 + 3\frac{B_{23}}{\beta^3}g_2k_5 = 0.330294694 \qquad \text{A136}$$

$$L_{31} = (B_{11} + 0.5B_{12})g_2k_1 + (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + 3\frac{B_{13}}{\beta}g_2k_4 + \frac{B_{23}}{\beta^3}g_2k_5 = 4.865151837 \qquad \text{A137}$$

$$L_{32} = (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + (0.5B_{12} + B_{22})\frac{g_2}{\beta^4}k_3 + \frac{B_{13}}{\beta}g_2k_4 + 3\frac{B_{23}}{\beta^3}g_2k_5 = 0.330294694 \qquad \text{A138}$$

$$P_2 = \frac{(L_{12}.L_{23} - L_{13}.L_{22})}{({L_{12}}^2 - L_{11}L_{22})} = 0.038617479 \qquad \text{A139}$$

$$P_3 = \frac{(L_{12}.L_{13} - L_{11}L_{23})}{({L_{12}}^2 - L_{11}L_{22})} = 0.006643166 \qquad \text{A140}$$

$$k_{T1} = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 = 5.721428182 \qquad \text{A141}$$

$$k_{T2} = \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 = 0.583288096 \qquad \text{A142}$$

$$k_{T3} = \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 = 0.234778329 \qquad \text{A143}$$

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 \quad = \quad 0 \qquad \text{A144}$$

$$k_{T5} = \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 \quad = \quad 0 \qquad \text{A145}$$

$$k_T = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 + \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 +$$
$$\frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 + \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 =$$
$$k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = 6.539494607 \qquad \text{A146}$$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.006116681.\frac{qa^4}{D_0} \qquad \text{A147}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 7.38159E-05.\frac{qa^3}{D_0} \qquad \text{A148}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 1.26982E-05.\frac{qa^3}{D_0} \qquad \text{A149}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = 0.007150065.\frac{qa^4}{E_0t^3} \qquad \text{A150}$$

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = -17.83292627.\frac{qa^3}{E_0t^2} \qquad \text{A151}$$

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = -18.2231017.\frac{qa^3}{E_0t^2} \qquad \text{A152}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} +\right.$$
$$\left.\frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.84657694.\frac{qa^2}{E_0t^2} \qquad \text{A153}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} +\right.$$
$$\left.\frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.02124695.\frac{qa^2}{E_0t^2} \qquad \text{A154}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} +\right.$$
$$\left.\frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.036056028.\frac{qa^2}{E_0t^2} \qquad \text{A155}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.706860774.\frac{qa}{E_0t} \qquad \text{A156}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = 0.048639051.\frac{qa}{E_0t} \qquad \text{A157}$$

For square plate, $\beta = 1$, $a/t = 50$, $\theta = \mathbf{0^o}$

$$L_{11} = g_3 \mathrm{B}_{11} k_1 + \frac{\mathrm{B}_{33}}{\beta^2} g_3 k_2 + 2\frac{B_{13}}{\beta} g_3 k_4 + \mathrm{B}_{44}.\left(\frac{a}{t}\right)^2 . g_4 . k_6 \quad = \quad 194.6240474 \qquad \text{A158}$$

$$L_{12} = (\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_3}{\beta^2} k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 \quad = \quad 0.11439794 \qquad \text{A159}$$

$$L_{13} = (\mathrm{B}_{11} + 0.5\mathrm{B}_{12}) g_2 k_1 + (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2} k_2 + 3\frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 \quad = \quad 4.865151837 \qquad \text{A160}$$

$$L_{21} = (\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_3}{\beta^2} . k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 \quad = \quad 0.11439794 \qquad \text{A161}$$

$$L_{22} = \frac{\mathrm{B}_{22}}{\beta^4} g_3 k_3 + 2\frac{B_{23}}{\beta^3} g_3 k_5 + \frac{\mathrm{B}_{33}}{\beta^2} g_3 k_2 + \frac{\mathrm{B}_{55}}{\beta^2} . \left(\frac{a}{t}\right)^2 . g_4 k_7 \quad = 76.51868689 \qquad \text{A162}$$

$$L_{23} = (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2} k_2 + (0.5\mathrm{B}_{12} + \mathrm{B}_{22})\frac{g_2}{\beta^4} k_3 + \frac{B_{13}}{\beta} g_2 k_4 + 3\frac{B_{23}}{\beta^3} g_2 k_5 \quad = \quad 0.330294694 \qquad \text{A163}$$

$$L_{31} = (\mathrm{B}_{11} + 0.5\mathrm{B}_{12}) g_2 k_1 + (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2} k_2 + 3\frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 \quad = \quad 4.865151837 \qquad \text{A164}$$

$$L_{32} = (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2} k_2 + (0.5\mathrm{B}_{12} + \mathrm{B}_{22})\frac{g_2}{\beta^4} k_3 + \frac{B_{13}}{\beta} g_2 k_4 + 3\frac{B_{23}}{\beta^3} g_2 k_5 \quad = \quad 0.330294694 \qquad \text{A165}$$

$$\mathrm{P}_2 = \frac{(L_{12}.L_{23} - L_{13}.L_{22})}{({L_{12}}^2 - L_{11} L_{22})} \quad = \quad 0.024995176 \qquad \text{A166}$$

$$\mathrm{P}_3 = \frac{(L_{12}.L_{13} - L_{11} L_{23})}{({L_{12}}^2 - L_{11} L_{22})} \quad = \quad 0.004279155 \qquad \text{A167}$$

$$k_{T1} = [\mathrm{B}_{11} - \mathrm{B}_{11} g_2 \mathrm{P}_2 - 0.5\mathrm{B}_{12} g_2 \mathrm{P}_2] k_1 \quad = \quad 5.786099092 \qquad \text{A168}$$

$$k_{T2} = \frac{1}{2\beta^2}(2\mathrm{B}_{33} + \mathrm{B}_{12})[4 - g_2 \mathrm{P}_2 - g_2 \mathrm{P}_3] k_2 \quad = \quad 0.585170057 \qquad \text{A169}$$

$$k_{T3} = \frac{1}{\beta^4}[\mathrm{B}_{22} - \mathrm{B}_{22} g_2 \mathrm{P}_3 - 0.5\mathrm{B}_{12} g_2 \mathrm{P}_3] k_3 \quad = \quad 0.23528085 \qquad \text{A170}$$

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2 \mathrm{P}_2 - g_2 \mathrm{P}_3] k_4 \quad = \quad 0 \qquad \text{A171}$$

$$k_{T5} = \frac{B_{23}}{\beta^3} . [4 - g_2 \mathrm{P}_2 - 3g_2 \mathrm{P}_3] k_5 \quad = \quad 0 \qquad \text{A172}$$

$$k_T = [\mathrm{B}_{11} - \mathrm{B}_{11} g_2 \mathrm{P}_2 - 0.5\mathrm{B}_{12} g_2 \mathrm{P}_2] k_1 + \frac{1}{2\beta^2}(2\mathrm{B}_{33} + \mathrm{B}_{12})[4 - g_2 \mathrm{P}_2 - g_2 \mathrm{P}_3] k_2 + \frac{1}{\beta^4}[\mathrm{B}_{22} - \mathrm{B}_{22} g_2 \mathrm{P}_3 - 0.5\mathrm{B}_{12} g_2 \mathrm{P}_3] k_3 + \frac{B_{13}}{\beta}[4 - 3g_2 \mathrm{P}_2 - g_2 \mathrm{P}_3] k_4 + \frac{B_{23}}{\beta^3} . [4 - g_2 \mathrm{P}_2 - 3g_2 \mathrm{P}_3] k_5 = k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = 6.606549999 \qquad \text{A173}$$

$$\mathrm{A}_1 = \left(\frac{k_8}{k_T}\right)\frac{\mathrm{q}a^4}{\mathrm{D}_0} \quad = \quad 0.006054597.\frac{\mathrm{q}a^4}{\mathrm{D}_0} \qquad \text{A174}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2 . \frac{\partial h}{\partial R} . \frac{qa^3}{D_0} \quad = \quad 4.72924E-05 . \frac{qa^3}{D_0} \qquad A175$$

$$\phi_y = \left(\frac{k_8}{k_T}\right) \frac{P_3}{\beta} . \frac{\partial h}{\partial Q} \frac{qa^3}{D_0} \quad = \quad 8.09642E-06 . \frac{qa^3}{D_0} \qquad A176$$

$$w = \left(\frac{k_8}{k_T}\right) h . \frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = 0.007077493 . \frac{qa^4}{E_0 t^3} \qquad A177$$

$$u = 12[1-\mu_{xy}\mu_{yx}] \left(\frac{a}{t}\right)^2 \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . S . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} . \frac{qa}{E_0} \quad = \quad -27.83823085 . \frac{qa^3}{E_0 t^2} \qquad A178$$

$$v = 12[1-\mu_{xy}\mu_{yx}] \left(\frac{a}{t}\right)^2 \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{S}{\beta} . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial Q} . \frac{qa}{E_0} \quad = \quad -28.22921085 . \frac{qa^3}{E_0 t^2} \qquad A179$$

$$\sigma_R = 12qS . \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \left(B_{11} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\right) \quad = \quad 0.845730014 . \frac{qa^2}{E_0 t^2} \qquad A180$$

$$\sigma_Q = 12qS . \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \left(B_{21} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\right) \quad = \quad 0.021121358 . \frac{qa^2}{E_0 t^2} \qquad A181$$

$$\tau_{RQ} = 12qS . \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \left(B_{31} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\right) \quad = \quad 0.035883163 . \frac{qa^2}{E_0 t^2} \qquad A182$$

$$\tau_{RS} = 12q \left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2) . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} \quad = \quad 0.707612748 . \frac{qa}{E_0 t} \qquad A183$$

$$\tau_{QS} = 12q \left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2) . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial Q} \quad = \quad 0.048457101 . \frac{qa}{E_0 t} \qquad A184$$

For square plate, $\beta = 1$, $a/t = 60$, $\theta = 0^o$

$$L_{11} = g_3 B_{11} k_1 + \frac{B_{33}}{\beta^2} g_3 k_2 + 2 \frac{B_{13}}{\beta} g_3 k_4 + B_{44} . \left(\frac{a}{t}\right)^2 . g_4 . k_6 \quad = \quad 278.5425236 \qquad A185$$

$$L_{12} = (B_{12} + B_{33}) \frac{g_3}{\beta^2} k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 \quad = \quad 0.11439794 \qquad A186$$

$$L_{13} = (B_{11} + 0.5B_{12}) g_2 k_1 + (0.5B_{12} + B_{33}) \frac{g_2}{\beta^2} k_2 + 3 \frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 \quad = \quad 4.865151837 \qquad A187$$

$$L_{21} = (B_{12} + B_{33}) \frac{g_3}{\beta^2} . k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 \quad = \quad 0.11439794 \qquad A188$$

$$L_{22} = \frac{B_{22}}{\beta^4} g_3 k_3 + 2 \frac{B_{23}}{\beta^3} g_3 k_5 + \frac{B_{33}}{\beta^2} g_3 k_2 + \frac{B_{55}}{\beta^2} . \left(\frac{a}{t}\right)^2 . g_4 k_7 \quad = 110.0860774 \qquad A189$$

$$L_{23} = (0.5B_{12} + B_{33}) \frac{g_2}{\beta^2} k_2 + (0.5B_{12} + B_{22}) \frac{g_2}{\beta^4} k_3 + \frac{B_{13}}{\beta} g_2 k_4 + 3 \frac{B_{23}}{\beta^3} g_2 k_5 \quad = \quad 0.330294694 \qquad A190$$

$$L_{31} = (B_{11} + 0.5B_{12})g_2k_1 + (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + 3\frac{B_{13}}{\beta}g_2k_4 + \frac{B_{23}}{\beta^3}g_2k_5 = 4.865151837$$
A191

$$L_{32} = (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + (0.5B_{12} + B_{22})\frac{g_2}{\beta^4}k_3 + \frac{B_{13}}{\beta}g_2k_4 + 3\frac{B_{23}}{\beta^3}g_2k_5 = 0.330294694$$
A192

$$P_2 = \frac{(L_{12}.L_{23} - L_{13}.L_{22})}{(L_{12}{}^2 - L_{11}L_{22})} = 0.017465235$$ A193

$$P_3 = \frac{(L_{12}.L_{13} - L_{11}L_{23})}{(L_{12}{}^2 - L_{11}L_{22})} = 0.002982182$$ A194

$$k_{T1} = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 = 5.821846948$$ A195

$$k_{T2} = \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 = 0.58620919$$ A196

$$k_{T3} = \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 = 0.23555655$$ A197

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 = 0$$ A198

$$k_{T5} = \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 = 0$$ A199

$$k_T = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 + \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 + \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 + \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 = k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = 6.643612688$$ A200

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.006020821.\frac{qa^4}{D_0}$$ A201

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 3.2861E-05.\frac{qa^3}{D_0}$$ A202

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 5.61099E-06.\frac{qa^3}{D_0}$$ A203

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00703801.\frac{qa^4}{E_0t^3}$$ A204

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -40.06692285.\frac{qa^3}{E_0t^2}$$ A205

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -40.45834125.\frac{qa^3}{E_0t^2}$$ A206

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.845269554.\frac{qa^2}{E_0t^2}$$ A207

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.021052881.\frac{qa^2}{E_0t^2} \quad \text{A208}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.035789006.\frac{qa^2}{E_0t^2} \quad \text{A209}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.708022078.\frac{qa}{E_0t} \quad \text{A210}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.048357794.\frac{qa}{E_0t} \quad \text{A211}$$

For square plate, $\beta = 1$, $a/t = 70$, $\theta = \mathbf{0^o}$

$$L_{11} = g_3B_{11}k_1+\frac{B_{33}}{\beta^2}g_3k_2+2\frac{B_{13}}{\beta}g_3k_4+B_{44}.\left(\frac{a}{t}\right)^2.g_4.k_6 = 377.7189046 \quad \text{A212}$$

$$L_{12} = (B_{12}+B_{33})\frac{g_3}{\beta^2}k_2+\frac{B_{13}}{\beta}g_3k_4+\frac{B_{23}}{\beta^3}g_3k_5 = 0.11439794 \quad \text{A213}$$

$$L_{13} = (B_{11}+0.5B_{12})g_2k_1+(0.5B_{12}+B_{33})\frac{g_2}{\beta^2}k_2+3\frac{B_{13}}{\beta}g_2k_4+\frac{B_{23}}{\beta^3}g_2k_5 = 4.865151837 \quad \text{A214}$$

$$L_{21} = (B_{12}+B_{33})\frac{g_3}{\beta^2}.k_2+\frac{B_{13}}{\beta}g_3k_4+\frac{B_{23}}{\beta^3}g_3k_5 = 0.11439794 \quad \text{A215}$$

$$L_{22} = \frac{B_{22}}{\beta^4}g_3k_3+2\frac{B_{23}}{\beta^3}g_3k_5+\frac{B_{33}}{\beta^2}g_3k_2+\frac{B_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2.g_4k_7 = 149.7566298 \quad \text{A216}$$

$$L_{23} = (0.5B_{12}+B_{33})\frac{g_2}{\beta^2}k_2+(0.5B_{12}+B_{22})\frac{g_2}{\beta^4}k_3+\frac{B_{13}}{\beta}g_2k_4+3\frac{B_{23}}{\beta^3}g_2k_5 = 0.330294694 \quad \text{A217}$$

$$L_{31} = (B_{11}+0.5B_{12})g_2k_1+(0.5B_{12}+B_{33})\frac{g_2}{\beta^2}k_2+3\frac{B_{13}}{\beta}g_2k_4+\frac{B_{23}}{\beta^3}g_2k_5 = 4.865151837 \quad \text{A218}$$

$$L_{32} = (0.5B_{12}+B_{33})\frac{g_2}{\beta^2}k_2+(0.5B_{12}+B_{22})\frac{g_2}{\beta^4}k_3+\frac{B_{13}}{\beta}g_2k_4+3\frac{B_{23}}{\beta^3}g_2k_5 = 0.330294694 \quad \text{A219}$$

$$P_2 = \frac{(L_{12}.L_{23}-L_{13}.L_{22})}{(L_{12}{}^2-L_{11}L_{22})} = 0.012879685 \quad \text{A220}$$

$$P_3 = \frac{(L_{12}.L_{13}-L_{11}L_{23})}{(L_{12}{}^2-L_{11}L_{22})} = 0.002195704 \quad \text{A221}$$

$$k_{T1} = [B_{11}-B_{11}g_2P_2-0.5B_{12}g_2P_2]k_1 = 5.843616518 \quad \text{A222}$$

$$k_{T2} = \frac{1}{2\beta^2}(2B_{33}+B_{12})[4-g_2P_2-g_2P_3]k_2 = 0.586841602 \quad \text{A223}$$

$$k_{T3} = \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 = 0.235723732 \quad \text{A224}$$

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 = 0 \quad \text{A225}$$

$$k_{T5} = \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 = 0 \quad \text{A226}$$

$$k_T = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 + \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 + \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 + \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 = k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = 6.666181853 \quad \text{A227}$$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.006000436.\frac{qa^4}{D_0} \quad \text{A228}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 2.41512E-05.\frac{qa^3}{D_0} \quad \text{A229}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 4.11725E-06.\frac{qa^3}{D_0} \quad \text{A230}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.007014182.\frac{qa^4}{E_0t^3} \quad \text{A231}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -54.51900712.\frac{qa^3}{E_0t^2} \quad \text{A232}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -54.91069031.\frac{qa^3}{E_0t^2} \quad \text{A233}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.844991776.\frac{qa^2}{E_0t^2} \quad \text{A234}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.021011505.\frac{qa^2}{E_0t^2} \quad \text{A235}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.035732146.\frac{qa^2}{E_0t^2} \quad \text{A236}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.708269182.\frac{qa}{E_0t} \quad \text{A237}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.048297755.\frac{qa}{E_0t} \quad \text{A238}$$

For square plate, $\beta = 1$, $a/t = 80$, $\theta = \mathbf{0^o}$

$$L_{11} = g_3\mathrm{B}_{11}k_1 + \frac{\mathrm{B}_{33}}{\beta^2}g_3k_2 + 2\frac{B_{13}}{\beta}g_3k_4 + \mathrm{B}_{44}.\left(\frac{a}{t}\right)^2.g_4.k_6 \quad = \quad 492.1531903 \qquad \text{A239}$$

$$L_{12} = (\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_3}{\beta^2}k_2 + \frac{B_{13}}{\beta}g_3k_4 + \frac{B_{23}}{\beta^3}g_3k_5 \quad = \quad 0.11439794 \qquad \text{A240}$$

$$L_{13} = (\mathrm{B}_{11} + 0.5\mathrm{B}_{12})g_2k_1 + (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2}k_2 + 3\frac{B_{13}}{\beta}g_2k_4 + \frac{B_{23}}{\beta^3}g_2k_5 \;=\; 4.865151837 \qquad \text{A241}$$

$$L_{21} = (\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_3}{\beta^2}.k_2 + \frac{B_{13}}{\beta}g_3k_4 + \frac{B_{23}}{\beta^3}g_3k_5 \quad = \quad 0.11439794 \qquad \text{A242}$$

$$L_{22} = \frac{\mathrm{B}_{22}}{\beta^4}g_3k_3 + 2\frac{B_{23}}{\beta^3}g_3k_5 + \frac{\mathrm{B}_{33}}{\beta^2}g_3k_2 + \frac{\mathrm{B}_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2.g_4k_7 \;=\; 195.530344 \qquad \text{A243}$$

$$L_{23} = (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2}k_2 + (0.5\mathrm{B}_{12} + \mathrm{B}_{22})\frac{g_2}{\beta^4}k_3 + \frac{B_{13}}{\beta}g_2k_4 + 3\frac{B_{23}}{\beta^3}g_2k_5 \;=\; 0.330294694 \qquad \text{A244}$$

$$L_{31} = (\mathrm{B}_{11} + 0.5\mathrm{B}_{12})g_2k_1 + (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2}k_2 + 3\frac{B_{13}}{\beta}g_2k_4 + \frac{B_{23}}{\beta^3}g_2k_5 \;=\; 4.865151837 \qquad \text{A245}$$

$$L_{32} = (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2}k_2 + (0.5\mathrm{B}_{12} + \mathrm{B}_{22})\frac{g_2}{\beta^4}k_3 + \frac{B_{13}}{\beta}g_2k_4 + 3\frac{B_{23}}{\beta^3}g_2k_5 \;=\; 0.330294694 \qquad \text{A246}$$

$$\mathrm{P}_2 = \frac{(L_{12}.L_{23} - L_{13}.L_{22})}{({L_{12}}^2 - L_{11}L_{22})} \quad = \quad 0.009885051 \qquad \text{A247}$$

$$\mathrm{P}_3 = \frac{(L_{12}.L_{13} - L_{11}L_{23})}{({L_{12}}^2 - L_{11}L_{22})} \quad = \quad 0.001683441 \qquad \text{A248}$$

$$k_{T1} = [\mathrm{B}_{11} - \mathrm{B}_{11}g_2\mathrm{P}_2 - 0.5\mathrm{B}_{12}g_2\mathrm{P}_2]k_1 \quad = \quad 5.857833332 \qquad \text{A249}$$

$$k_{T2} = \frac{1}{2\beta^2}(2\mathrm{B}_{33} + \mathrm{B}_{12})[4 - g_2\mathrm{P}_2 - g_2\mathrm{P}_3]k_2 \;=\; 0.587254446 \qquad \text{A250}$$

$$k_{T3} = \frac{1}{\beta^4}[\mathrm{B}_{22} - \mathrm{B}_{22}g_2\mathrm{P}_3 - 0.5\mathrm{B}_{12}g_2\mathrm{P}_3]k_3 \quad = \quad 0.235832625 \qquad \text{A251}$$

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2\mathrm{P}_2 - g_2\mathrm{P}_3]k_4 \quad = \quad 0 \qquad \text{A252}$$

$$k_{T5} = \frac{B_{23}}{\beta^3}.[4 - g_2\mathrm{P}_2 - 3g_2\mathrm{P}_3]k_5 \quad = \quad 0 \qquad \text{A253}$$

$$k_T = [\mathrm{B}_{11} - \mathrm{B}_{11}g_2\mathrm{P}_2 - 0.5\mathrm{B}_{12}g_2\mathrm{P}_2]k_1 + \frac{1}{2\beta^2}(2\mathrm{B}_{33} + \mathrm{B}_{12})[4 - g_2\mathrm{P}_2 - g_2\mathrm{P}_3]k_2 + \frac{1}{\beta^4}[\mathrm{B}_{22} - \mathrm{B}_{22}g_2\mathrm{P}_3 - 0.5\mathrm{B}_{12}g_2\mathrm{P}_3]k_3 + \frac{B_{13}}{\beta}[4 - 3g_2\mathrm{P}_2 - g_2\mathrm{P}_3]k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2\mathrm{P}_2 - 3g_2\mathrm{P}_3]k_5 = k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = 6.680920403 \qquad \text{A254}$$

$$\mathrm{A}_1 = \left(\frac{k_8}{k_T}\right)\frac{\mathrm{q}a^4}{\mathrm{D}_0} \quad = \quad 0.005987199.\frac{\mathrm{q}a^4}{\mathrm{D}_0} \qquad \text{A255}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2 . \frac{\partial h}{\partial R} . \frac{qa^3}{D_0} = 1.84949E-05 . \frac{qa^3}{D_0} \quad A256$$

$$\phi_y = \left(\frac{k_8}{k_T}\right) \frac{P_3}{\beta} . \frac{\partial h}{\partial Q} \frac{qa^3}{D_0} = 3.14972E-06 . \frac{qa^3}{D_0} \quad A257$$

$$w = \left(\frac{k_8}{k_T}\right) h . \frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} = 0.006998708 . \frac{qa^4}{E_0 t^3} \quad A258$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2 \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . S . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} . \frac{qa}{E_0} = -71.19448566 . \frac{qa^3}{E_0 t^2} \quad A259$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2 \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{S}{\beta} . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial Q} . \frac{qa}{E_0} = -71.5863409 . \frac{qa^3}{E_0 t^2} \quad A260$$

$$\sigma_R = 12qS . \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \Big(B_{11} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\Big) = 0.844811432 . \frac{qa^2}{E_0 t^2} \quad A261$$

$$\sigma_Q = 12qS . \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \Big(B_{21} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\Big) = 0.020984616 . \frac{qa^2}{E_0 t^2} \quad A262$$

$$\tau_{RQ} = 12qS . \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \Big(B_{31} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\Big) = 0.035695207 . \frac{qa^2}{E_0 t^2} \quad A263$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2) . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} = 0.708429678 . \frac{qa}{E_0 t} \quad A264$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2) . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial Q} = 0.048258723 . \frac{qa}{E_0 t} \quad A265$$

For square plate, $\beta = 1$, a/t = 90, $\theta = 0^o$

$$L_{11} = g_3 B_{11} k_1 + \frac{B_{33}}{\beta^2} g_3 k_2 + 2\frac{B_{13}}{\beta} g_3 k_4 + B_{44} . \left(\frac{a}{t}\right)^2 . g_4 . k_6 = 621.8453808 \quad A266$$

$$L_{12} = (B_{12} + B_{33})\frac{g_3}{\beta^2} k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 = 0.11439794 \quad A267$$

$$L_{13} = (B_{11} + 0.5B_{12}) g_2 k_1 + (0.5B_{12} + B_{33})\frac{g_2}{\beta^2} k_2 + 3\frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 = 4.865151837 \quad A268$$

$$L_{21} = (B_{12} + B_{33})\frac{g_3}{\beta^2} . k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 = 0.11439794 \quad A269$$

$$L_{22} = \frac{B_{22}}{\beta^4} g_3 k_3 + 2\frac{B_{23}}{\beta^3} g_3 k_5 + \frac{B_{33}}{\beta^2} g_3 k_2 + \frac{B_{55}}{\beta^2} . \left(\frac{a}{t}\right)^2 . g_4 k_7 = 247.4072202 \quad A270$$

$$L_{23} = (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + (0.5B_{12} + B_{22})\frac{g_2}{\beta^4}k_3 + \frac{B_{13}}{\beta}g_2k_4 + 3\frac{B_{23}}{\beta^3}g_2k_5 \quad = \; 0.330294694$$
A271

$$L_{31} = (B_{11} + 0.5B_{12})g_2k_1 + (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + 3\frac{B_{13}}{\beta}g_2k_4 + \frac{B_{23}}{\beta^3}g_2k_5 \quad = \; 4.865151837$$
A272

$$L_{32} = (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + (0.5B_{12} + B_{22})\frac{g_2}{\beta^4}k_3 + \frac{B_{13}}{\beta}g_2k_4 + 3\frac{B_{23}}{\beta^3}g_2k_5 \quad = \; 0.330294694$$
A273

$$P_2 = \frac{(L_{12}.L_{23} - L_{13}.L_{22})}{(L_{12}{}^2 - L_{11}L_{22})} \quad = \quad 0.007823487$$ A274

$$P_3 = \frac{(L_{12}.L_{13} - L_{11}L_{23})}{(L_{12}{}^2 - L_{11}L_{22})} \quad = \quad 0.001331407$$ A275

$$k_{T1} = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 \quad = \; 5.867620457$$ A276

$$k_{T2} = \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 \; = \; 0.587538582$$ A277

$$k_{T3} = \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 \quad = \; 0.235907457$$ A278

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 \quad = \quad 0$$ A279

$$k_{T5} = \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 \quad = \quad 0$$ A280

$$k_T = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 + \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 +$$
$$\frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 + \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 =$$
$$k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = 6.691066497$$ A281

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.00597812.\frac{qa^4}{D_0}$$ A282

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 1.46155E-05.\frac{qa^3}{D_0}$$ A283

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\;\frac{qa^3}{D_0} \quad = \quad 2.48728E-06.\frac{qa^3}{D_0}$$ A284

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = 0.006988096.\frac{qa^4}{E_0t^3}$$ A285

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -90.09335943.\frac{qa^3}{E_0t^2}$$ A286

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -90.48533272.\frac{qa^3}{E_0t^2}$$ A287

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.844687763.\frac{qa^2}{E_0t^2} \quad A288$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.020966164.\frac{qa^2}{E_0t^2} \quad A289$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.035669865.\frac{qa^2}{E_0t^2} \quad A290$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.708539767.\frac{qa}{E_0t} \quad A291$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.048231933.\frac{qa}{E_0t} \quad A292$$

For square plate, β = 1, a/t = 100, θ = 0^o

$$L_{11} = g_3B_{11}k_1+\frac{B_{33}}{\beta^2}g_3k_2+2\frac{B_{13}}{\beta}g_3k_4+B_{44}.\left(\frac{a}{t}\right)^2.g_4.k_6 = 766.795476 \quad A293$$

$$L_{12} = (B_{12}+B_{33})\frac{g_3}{\beta^2}k_2+\frac{B_{13}}{\beta}g_3k_4+\frac{B_{23}}{\beta^3}g_3k_5 = 0.11439794 \quad A294$$

$$L_{13} = (B_{11}+0.5B_{12})g_2k_1+(0.5B_{12}+B_{33})\frac{g_2}{\beta^2}k_2+3\frac{B_{13}}{\beta}g_2k_4+\frac{B_{23}}{\beta^3}g_2k_5 = 4.865151837 \quad A295$$

$$L_{21} = (B_{12}+B_{33})\frac{g_3}{\beta^2}.k_2+\frac{B_{13}}{\beta}g_3k_4+\frac{B_{23}}{\beta^3}g_3k_5 = 0.11439794 \quad A296$$

$$L_{22} = \frac{B_{22}}{\beta^4}g_3k_3+2\frac{B_{23}}{\beta^3}g_3k_5+\frac{B_{33}}{\beta^2}g_3k_2+\frac{B_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2.g_4k_7 = 305.3872583 \quad A297$$

$$L_{23} = (0.5B_{12}+B_{33})\frac{g_2}{\beta^2}k_2+(0.5B_{12}+B_{22})\frac{g_2}{\beta^4}k_3+\frac{B_{13}}{\beta}g_2k_4+3\frac{B_{23}}{\beta^3}g_2k_5 = 0.330294694 \quad A298$$

$$L_{31} = (B_{11}+0.5B_{12})g_2k_1+(0.5B_{12}+B_{33})\frac{g_2}{\beta^2}k_2+3\frac{B_{13}}{\beta}g_2k_4+\frac{B_{23}}{\beta^3}g_2k_5 = 4.865151837 \quad A299$$

$$L_{32} = (0.5B_{12}+B_{33})\frac{g_2}{\beta^2}k_2+(0.5B_{12}+B_{22})\frac{g_2}{\beta^4}k_3+\frac{B_{13}}{\beta}g_2k_4+3\frac{B_{23}}{\beta^3}g_2k_5 = 0.330294694 \quad A300$$

$$P_2 = \frac{(L_{12}.L_{23}-L_{13}.L_{22})}{({L_{12}}^2-L_{11}L_{22})} = 0.006344623 \quad A301$$

$$P_3 = \frac{(L_{12}.L_{13}-L_{11}L_{23})}{({L_{12}}^2-L_{11}L_{22})} = 0.001079183 \quad A302$$

$$k_{T1} = [\mathrm{B}_{11} - \mathrm{B}_{11}g_2\mathrm{P}_2 - 0.5\mathrm{B}_{12}g_2\mathrm{P}_2]k_1 \quad = \quad 5.874641259 \qquad \text{A303}$$

$$k_{T2} = \frac{1}{2\beta^2}(2\mathrm{B}_{33} + \mathrm{B}_{12})[4 - g_2\mathrm{P}_2 - g_2\mathrm{P}_3]k_2 = 0.587742372 \qquad \text{A304}$$

$$k_{T3} = \frac{1}{\beta^4}[\mathrm{B}_{22} - \mathrm{B}_{22}g_2\mathrm{P}_3 - 0.5\mathrm{B}_{12}g_2\mathrm{P}_3]k_3 \quad = 0.235961073 \qquad \text{A305}$$

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2\mathrm{P}_2 - g_2\mathrm{P}_3]k_4 \quad = \quad 0 \qquad \text{A306}$$

$$k_{T5} = \frac{B_{23}}{\beta^3}.[4 - g_2\mathrm{P}_2 - 3g_2\mathrm{P}_3]k_5 \quad = \quad 0 \qquad \text{A307}$$

$$k_T = [\mathrm{B}_{11} - \mathrm{B}_{11}g_2\mathrm{P}_2 - 0.5\mathrm{B}_{12}g_2\mathrm{P}_2]k_1 + \frac{1}{2\beta^2}(2\mathrm{B}_{33} + \mathrm{B}_{12})[4 - g_2\mathrm{P}_2 - g_2\mathrm{P}_3]k_2 + \frac{1}{\beta^4}[\mathrm{B}_{22} - \mathrm{B}_{22}g_2\mathrm{P}_3 - 0.5\mathrm{B}_{12}g_2\mathrm{P}_3]k_3 + \frac{B_{13}}{\beta}[4 - 3g_2\mathrm{P}_2 - g_2\mathrm{P}_3]k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2\mathrm{P}_2 - 3g_2\mathrm{P}_3]k_5 = k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = 6.698344704 \qquad \text{A308}$$

$$\mathrm{A}_1 = \left(\frac{k_8}{k_T}\right)\frac{\mathrm{q}a^4}{\mathrm{D}_0} \quad = \quad 0.005971625.\frac{\mathrm{q}a^4}{\mathrm{D}_0} \qquad \text{A309}$$

$$\phi_\mathrm{x} = \left(\frac{\mathrm{k}_8}{\mathrm{k}_\mathrm{T}}\right)\mathrm{P}_2.\frac{\partial \mathrm{h}}{\partial \mathrm{R}}.\frac{\mathrm{qa}^3}{\mathrm{D}_0} \quad = \quad 1.18399\mathrm{E}-05.\frac{\mathrm{qa}^3}{\mathrm{D}_0} \qquad \text{A310}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{\mathrm{P}_3}{\beta}.\frac{\partial \mathrm{h}}{\partial Q}\ \frac{\mathrm{q}a^3}{\mathrm{D}_0} \quad = \quad 2.0139\mathrm{E}-06.\frac{\mathrm{q}a^3}{\mathrm{D}_0} \qquad \text{A311}$$

$$\mathrm{w} = \left(\frac{k_8}{k_T}\right)\mathrm{h}.\frac{12[1-\mu_{\mathrm{xy}}\mu_{\mathrm{yx}}]\mathrm{q}a^4}{\mathrm{E}_0\mathrm{t}^3} \quad = 0.006980503.\frac{\mathrm{q}a^4}{\mathrm{E}_0\mathrm{t}^3} \qquad \text{A312}$$

$$u = 12[1 - \mu_{\mathrm{xy}}\mu_{\mathrm{yx}}]\left(\frac{\mathrm{a}}{\mathrm{t}}\right)^2\left[\mathrm{P}_2 - \frac{4}{3}\mathrm{P}_2 S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial \mathrm{h}}{\partial R}.\frac{\mathrm{qa}}{\mathrm{E}_0} \quad = \quad -111.215629.\frac{\mathrm{q}a^3}{\mathrm{E}_0\mathrm{t}^2} \qquad \text{A313}$$

$$v = 12[1 - \mu_{\mathrm{xy}}\mu_{\mathrm{yx}}]\left(\frac{\mathrm{a}}{\mathrm{t}}\right)^2\left[\mathrm{P}_3 - \frac{4}{3}\mathrm{P}_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial \mathrm{h}}{\partial Q}.\frac{\mathrm{qa}}{\mathrm{E}_0} \quad = \quad -111.6076867.\frac{\mathrm{q}a^3}{\mathrm{E}_0\mathrm{t}^2} \qquad \text{A314}$$

$$\sigma_\mathrm{R} = 12\mathrm{q}S.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(\mathrm{B}_{11}.\left[\mathrm{P}_2 - \frac{4}{3}\mathrm{P}_2S^2 - 1\right].\frac{\partial^2\mathrm{h}}{\partial R^2} + \frac{\mathrm{B}_{12}}{\beta^2}.\left[\mathrm{P}_3 - \frac{4}{3}\mathrm{P}_3S^2 - 1\right].\frac{\partial^2\mathrm{h}}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[\mathrm{P}_2 + \mathrm{P}_3 - \frac{4}{3}\mathrm{P}_2S^2 - \frac{4}{3}\mathrm{P}_3S^2 - 2\right].\frac{\partial^2\mathrm{h}}{\partial \mathrm{R}\partial Q}\right) = 0.844599292.\frac{\mathrm{q}a^2}{\mathrm{E}_0\mathrm{t}^2} \qquad \text{A315}$$

$$\sigma_\mathrm{Q} = 12\mathrm{q}S.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(\mathrm{B}_{21}.\left[\mathrm{P}_2 - \frac{4}{3}\mathrm{P}_2S^2 - 1\right].\frac{\partial^2\mathrm{h}}{\partial R^2} + \frac{\mathrm{B}_{22}}{\beta^2}.\left[\mathrm{P}_3 - \frac{4}{3}\mathrm{P}_3S^2 - 1\right].\frac{\partial^2\mathrm{h}}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[\mathrm{P}_2 + \mathrm{P}_3 - \frac{4}{3}\mathrm{P}_2S^2 - \frac{4}{3}\mathrm{P}_3S^2 - 2\right].\frac{\partial^2\mathrm{h}}{\partial \mathrm{R}\partial Q}\right) = 0.020952958.\frac{\mathrm{q}a^2}{\mathrm{E}_0\mathrm{t}^2} \qquad \text{A316}$$

$$\tau_\mathrm{RQ} = 12\mathrm{q}S.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(\mathrm{B}_{31}.\left[\mathrm{P}_2 - \frac{4}{3}\mathrm{P}_2S^2 - 1\right].\frac{\partial^2\mathrm{h}}{\partial R^2} + \frac{\mathrm{B}_{32}}{\beta^2}.\left[\mathrm{P}_3 - \frac{4}{3}\mathrm{P}_3S^2 - 1\right].\frac{\partial^2\mathrm{h}}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[\mathrm{P}_2 + \mathrm{P}_3 - \frac{4}{3}\mathrm{P}_2S^2 - \frac{4}{3}\mathrm{P}_3S^2 - 2\right].\frac{\partial^2\mathrm{h}}{\partial \mathrm{R}\partial Q}\right) = 0.035651731.\frac{\mathrm{q}a^2}{\mathrm{E}_0\mathrm{t}^2} \qquad \text{A317}$$

$$\tau_\mathrm{RS} = 12\mathrm{q}\left(\frac{\mathrm{a}}{\mathrm{t}}\right)^3\mathrm{B}_{44}(\mathrm{P}_2 - 4\mathrm{P}_2S^2).\left(\frac{\mathrm{k}_8}{\mathrm{k}_\mathrm{T}}\right).\frac{\partial \mathrm{h}}{\partial \mathrm{R}} = 0.70861854.\frac{\mathrm{q}a}{\mathrm{E}_0\mathrm{t}} \qquad \text{A318}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.048212755.\frac{qa}{E_0 t} \quad A319$$

For square plate, β = 1, a/t = 5, θ = 15°

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.010651616.\frac{qa^4}{D_0} \quad A320$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.002775746.\frac{qa^3}{D_0} \quad A321$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 0.001187179.\frac{qa^3}{D_0} \quad A322$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.012451156.\frac{qa^4}{E_0t^3} \quad A323$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -0.221165566.\frac{qa^3}{E_0t^2} \quad A324$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.379625166.\frac{qa^3}{E_0t^2} \quad A325$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.6618064.\frac{qa^2}{E_0t^2} \quad A326$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.035091492.\frac{qa^2}{E_0t^2} \quad A327$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.151706436.\frac{qa^2}{E_0t^2} \quad A328$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.415321014.\frac{qa}{E_0 t} \quad A329$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.071052646.\frac{qa}{E_0 t} \quad A330$$

For square plate, β = 1, a/t = 10, θ = 15°

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.00676586.\frac{qa^4}{D_0} \quad A331$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.00088648.\frac{qa^3}{D_0} \quad A332$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 0.000404711.\frac{qa^3}{D_0} \quad A333$$

$$w = \left(\frac{k_8}{k_T}\right) h \,.\frac{12[1-\mu_{xy}\mu_{yx}]q a^4}{E_0 t^3} \quad = 0.00790892.\frac{q a^4}{E_0 t^3} \qquad A334$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\,P_2\,S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -0.911721669.\frac{q a^3}{E_0 t^2} \qquad A335$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -1.10394758.\frac{q a^3}{E_0 t^2} \qquad A336$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{11}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\Big) \quad = \quad 0.658215037.\frac{q a^2}{E_0 t^2} \qquad A337$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{21}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\Big) \quad = \quad 0.038004989.\frac{q a^2}{E_0 t^2} \qquad A338$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{31}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\Big) \quad = \quad 0.127244805.\frac{q a^2}{E_0 t^2} \qquad A339$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} \quad = \quad 0.530558371.\frac{q a}{E_0 t} \qquad A340$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = \quad 0.096887802.\frac{q a}{E_0 t} \qquad A341$$

For square plate, $\beta = 1$, $a/t = 20$, $\theta = \mathbf{15^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{q a^4}{D_0} \quad 0.005423432.\frac{q a^4}{D_0} \qquad A341$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2.\frac{\partial h}{\partial R}.\frac{q a^3}{D_0} \quad = \quad 0.000238155\,.\,\frac{q a^3}{D_0} \qquad A342$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\;\frac{q a^3}{D_0} \quad = \quad 0.000111199\,.\frac{q a^3}{D_0} \qquad A343$$

$$w = \left(\frac{k_8}{k_T}\right) h \,.\frac{12[1-\mu_{xy}\mu_{yx}]q a^4}{E_0 t^3} \quad = 0.006339696.\frac{q a^4}{E_0 t^3} \qquad A344$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\,P_2\,S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad 0.656303806.\frac{q a^3}{E_0 t^2} \qquad A345$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad 0.03916743.\frac{q a^3}{E_0 t^2} \qquad A346$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{11}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\Big) \quad = \quad 0.658215037.\frac{q a^2}{E_0 t^2} \qquad A347$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.038004989.\frac{qa^2}{E_0t^2} \quad \text{A348}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.119268053.\frac{qa^2}{E_0t^2} \quad \text{A349}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.57014279.\frac{qa}{E_0t} \quad \text{A350}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.106484013.\frac{qa}{E_0t} \quad \text{A351}$$

For square plate, $\beta = 1$, $a/t = 30$, $\theta = 15^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.00515196.\frac{qa^4}{D_0} \quad \text{A352}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.00010733.\frac{qa^3}{D_0} \quad \text{A353}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 5.03425E-05.\frac{qa^3}{D_0} \quad \text{A354}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.006022359.\frac{qa^4}{E_0t^3} \quad \text{A355}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -8.28677564.\frac{qa^3}{E_0t^2} \quad \text{A356}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -8.491417634.\frac{qa^3}{E_0t^2} \quad \text{A357}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.655873912.\frac{qa^2}{E_0t^2} \quad \text{A358}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.039412595.\frac{qa^2}{E_0t^2} \quad \text{A359}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.11768564.\frac{qa^2}{E_0t^2} \quad \text{A360}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.578133048.\frac{qa}{E_0t} \quad \text{A361}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.108468023.\frac{qa}{E_0t} \quad \text{A362}$$

For square plate, $\beta = 1$, a/t = 40, $\theta = \mathbf{15^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.00505509.\frac{qa^4}{D_0} \quad \text{A363}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 6.06707E-05.\frac{qa^3}{D_0} \quad \text{A364}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 2.85034E-05.\frac{qa^3}{D_0} \quad \text{A365}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.005909124.\frac{qa^4}{E_0t^3} \quad \text{A366}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -14.74003459.\frac{qa^3}{E_0t^2} \quad \text{A367}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -14.94539068.\frac{qa^3}{E_0t^2} \quad \text{A368}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.655716938.\frac{qa^2}{E_0t^2} \quad \text{A369}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.039500909.\frac{qa^2}{E_0t^2} \quad \text{A370}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.117123511.\frac{qa^2}{E_0t^2} \quad \text{A371}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.580983019.\frac{qa}{E_0t} \quad \text{A372}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.109179557.\frac{qa}{E_0t} \quad \text{A373}$$

For square plate, $\beta = 1$, a/t = 50, $\theta = \mathbf{15^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.00500992.\frac{qa^4}{D_0} \quad \text{A374}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 3.89181E-05.\frac{qa^3}{D_0} \quad \text{A375}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 1.82977E-05.\frac{qa^3}{D_0} \quad \text{A376}$$

$$w = \left(\frac{k_8}{k_T}\right) h \,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = 0.005856323.\frac{qa^4}{E_0 t^3} \qquad A377$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\,P_2\,S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -23.03708284.\frac{qa^3}{E_0 t^2} \qquad A378$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -23.24277067.\frac{qa^3}{E_0 t^2} \qquad A379$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.655643098.\frac{qa^2}{E_0 t^2} \qquad A380$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.039542239.\frac{qa^2}{E_0 t^2} \qquad A381$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.11686185.\frac{qa^2}{E_0 t^2} \qquad A382$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.582311721.\frac{qa}{E_0 t} \qquad A383$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = 0.109511985.\frac{qa}{E_0 t} \qquad A384$$

For square plate, $\beta = 1$, a/t = 60, $\theta = \mathbf{15^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.004985294.\frac{qa^4}{D_0} \qquad A385$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 2.70601E-05.\frac{qa^3}{D_0} \qquad A386$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\;\frac{qa^3}{D_0} \quad = \quad 1.27278E-05.\frac{qa^3}{D_0} \qquad A387$$

$$w = \left(\frac{k_8}{k_T}\right) h \,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = 0.005827537.\frac{qa^4}{E_0 t^3} \qquad A388$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\,P_2\,S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -33.17791981.\frac{qa^3}{E_0 t^2} \qquad A389$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -33.38378819.\frac{qa^3}{E_0 t^2} \qquad A390$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.655602669.\frac{qa^2}{E_0 t^2} \qquad A391$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.039564811.\frac{qa^2}{E_0t^2} \quad \text{A392}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.116719319.\frac{qa^2}{E_0t^2} \quad \text{A393}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.583036045.\frac{qa}{E_0t} \quad \text{A394}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.109693391.\frac{qa}{E_0t} \quad \text{A395}$$

For square plate, $\beta = 1$, a/t = 70, $\theta = 15^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.004970415.\frac{qa^4}{D_0} \quad \text{A396}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.98958E-05.\frac{qa^3}{D_0} \quad \text{A397}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 9.3604E-06.\frac{qa^3}{D_0} \quad \text{A398}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.005810144.\frac{qa^4}{E_0t^3} \quad \text{A399}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -45.16254541.\frac{qa^3}{E_0t^2} \quad \text{A400}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -45.36852276.\frac{qa^3}{E_0t^2} \quad \text{A401}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.655578183.\frac{qa^2}{E_0t^2} \quad \text{A402}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.039578463.\frac{qa^2}{E_0t^2} \quad \text{A403}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.116633244.\frac{qa^2}{E_0t^2} \quad \text{A404}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.583473665.\frac{qa}{E_0t} \quad \text{A405}$$

$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.109803057.\frac{qa}{E_0 t}$ A406

For square plate, $\beta = 1$, a/t = 80, $\theta = 15^o$

$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.004960746.\frac{qa^4}{D_0}$ A407

$\phi_x = \left(\frac{k_8}{k_T}\right) P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.52401E-05.\frac{qa^3}{D_0}$ A408

$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q} \frac{qa^3}{D_0} = 7.17121E-06.\frac{qa^3}{D_0}$ A409

$w = \left(\frac{k_8}{k_T}\right) h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} = 0.005798841.\frac{qa^4}{E_0 t^3}$ A410

$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3} P_2 S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -58.99095958.\frac{qa^3}{E_0 t^2}$ A411

$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -59.1970077.\frac{qa^3}{E_0 t^2}$ A412

$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.655562246.\frac{qa^2}{E_0 t^2}$ A413

$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.039587341.\frac{qa^2}{E_0 t^2}$ A414

$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.116577323.\frac{qa^2}{E_0 t^2}$ A415

$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.583758051.\frac{qa}{E_0 t}$ A416

$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.109874348.\frac{qa}{E_0 t}$ A417

For square plate, $\beta = 1$, a/t = 90, $\theta = 15^o$

$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.004954111.\frac{qa^4}{D_0}$ A418

$\phi_x = \left(\frac{k_8}{k_T}\right) P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.20456E-05.\frac{qa^3}{D_0}$ A419

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 5.66866E-06.\frac{qa^3}{D_0} \qquad A420$$

$$w = \left(\frac{k_8}{k_T}\right)h\,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = 0.005791085.\frac{qa^4}{E_0t^3} \qquad A421$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}\ P_2\ S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -74.66316232.\frac{qa^3}{E_0t^2} \qquad A422$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -74.86925898.\frac{qa^3}{E_0t^2} \qquad A423$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\right.$$
$$\left.\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.6555513.\frac{qa^2}{E_0t^2} \qquad A424$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\right.$$
$$\left.\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.039593435.\frac{qa^2}{E_0t^2} \qquad A425$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\right.$$
$$\left.\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial}\right) = 0.116538959.\frac{qa^2}{E_0t^2} \qquad A426$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} \quad = \quad 0.583953185.\frac{qa}{E_0t} \qquad A427$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = 0.109923278\frac{qa}{E_0t} \qquad A428$$

For square plate, $\beta = 1$, a/t = 100, $\theta = \mathbf{15^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.004949363.\frac{qa^4}{D_0} \qquad A429$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 9.75928E-06\,.\ \frac{qa^3}{D_0} \qquad A430$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 4.59308E-06.\frac{qa^3}{D_0} \qquad A431$$

$$w = \left(\frac{k_8}{k_T}\right)h\,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = 0.005785534.\frac{qa^4}{E_0t^3} \qquad A432$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}\ P_2\ S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -92.17915363.\frac{qa^3}{E_0t^2} \qquad A433$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -92.38528502.\frac{qa^3}{E_0t^2} \qquad A434$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{11}.\Big[P_2-\frac{4}{3}P_2S^2-1\Big].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\Big[P_3-\frac{4}{3}P_3S^2-1\Big].\frac{\partial^2 h}{\partial Q^2}+$$
$$\frac{B_{13}}{\beta}.\Big[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\Big].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.65554346.\frac{qa^2}{E_0t^2} \qquad A435$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{21}.\Big[P_2-\frac{4}{3}P_2S^2-1\Big].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\Big[P_3-\frac{4}{3}P_3S^2-1\Big].\frac{\partial^2 h}{\partial Q^2}+$$
$$\frac{B_{23}}{\beta}.\Big[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\Big].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.039597798.\frac{qa^2}{E_0t^2} \qquad A436$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{31}.\Big[P_2-\frac{4}{3}P_2S^2-1\Big].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\Big[P_3-\frac{4}{3}P_3S^2-1\Big].\frac{\partial^2 h}{\partial Q^2}+$$
$$\frac{B_{33}}{\beta}.\Big[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\Big].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.116511506.\frac{qa^2}{E_0t^2} \qquad A437$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.584092844.\frac{qa}{E_0t} \qquad A438$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.109958303\frac{qa}{E_0t} \qquad A439$$

For square plate, $\beta = 1$, a/t = 5, $\theta = 30^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.006624458.\frac{qa^4}{D_0} \qquad A440$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.001540535.\frac{qa^3}{D_0} \qquad A441$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\;\frac{qa^3}{D_0} = 0.001309947.\frac{qa^3}{D_0} \qquad A442$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.007743629.\frac{qa^4}{E_0t^3} \qquad A443$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\Big[P_2-\frac{4}{3}P_2S^2-1\Big].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -0.156076775.\frac{qa^3}{E_0t^2} \qquad A444$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\Big[P_3-\frac{4}{3}P_3S^2-1\Big].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.179077936.\frac{qa^3}{E_0t^2} \qquad A445$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{11}.\Big[P_2-\frac{4}{3}P_2S^2-1\Big].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\Big[P_3-\frac{4}{3}P_3S^2-1\Big].\frac{\partial^2 h}{\partial Q^2}+$$
$$\frac{B_{13}}{\beta}.\Big[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\Big].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.374327655.\frac{qa^2}{E_0t^2} \qquad A446$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{21}.\Big[P_2-\frac{4}{3}P_2S^2-1\Big].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\Big[P_3-\frac{4}{3}P_3S^2-1\Big].\frac{\partial^2 h}{\partial Q^2}+$$
$$\frac{B_{23}}{\beta}.\Big[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\Big].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.047866015.\frac{qa^2}{E_0t^2} \qquad A447$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.21099123.\frac{qa^2}{E_0t^2} \quad \text{A448}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.23050259.\frac{qa}{E_0t} \quad \text{A449}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.078400339\frac{qa}{E_0t} \quad \text{A450}$$

For square plate, $\beta = 1$, $a/t = 10$, $\theta = \mathbf{30^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.004861023.\frac{qa^4}{D_0} \quad \text{A451}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.000565973.\frac{qa^3}{D_0} \quad \text{A452}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 0.000633628.\frac{qa^3}{D_0} \quad \text{A453}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00568227.\frac{qa^4}{E_0t^3} \quad \text{A454}$$

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -0.6833401.\frac{qa^3}{E_0t^2} \quad \text{A455}$$

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.65634552.\frac{qa^3}{E_0t^2} \quad \text{A456}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.391836935.\frac{qa^2}{E_0t^2} \quad \text{A457}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.063819857.\frac{qa^2}{E_0t^2} \quad \text{A458}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.210844356.\frac{qa^2}{E_0t^2} \quad \text{A459}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.338734553.\frac{qa}{E_0t} \quad \text{A460}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.151690569.\frac{qa}{E_0t} \quad \text{A461}$$

For square plate, $\beta = 1$, $a/t = 20$, $\theta = \mathbf{30^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.004026605.\frac{qa^4}{D_0} \qquad A462$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.000162739.\frac{qa^3}{D_0} \qquad A463$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 0.000198499.\frac{qa^3}{D_0} \qquad A464$$

$$w = \left(\frac{k_8}{k_T}\right) h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} = 0.004706881.\frac{qa^4}{E_0 t^3} \qquad A465$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -2.75267306.\frac{qa^3}{E_0 t^2} \qquad A466$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -2.695599727.\frac{qa^3}{E_0 t^2} \qquad A467$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.396414701.\frac{qa^2}{E_0 t^2} \qquad A468$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.071606251.\frac{qa^2}{E_0 t^2} \qquad A469$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.214367004.\frac{qa^2}{E_0 t^2} \qquad A470$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.38959656.\frac{qa}{E_0 t} \qquad A471$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3 - 4P_3 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.190082624.\frac{qa}{E_0 t} \qquad A472$$

For square plate, $\beta = 1$, a/t = 30, $\theta = 30^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.003836625.\frac{qa^4}{D_0} \qquad A473$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 7.44742E-05.\frac{qa^3}{D_0} \qquad A474$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 9.23842E-05.\frac{qa^3}{D_0} \qquad A475$$

$$w = \left(\frac{k_8}{k_T}\right) h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} = 0.004484805.\frac{qa^4}{E_0 t^3} \qquad A476$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -6.190682107.\frac{qa^3}{E_0 t^2} \qquad A477$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -6.12636743.\frac{qa^3}{E_0t^2} \quad A478$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.397230092.\frac{qa^2}{E_0t^2} \quad A479$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.073393587.\frac{qa^2}{E_0t^2} \quad A480$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.215388873.\frac{qa^2}{E_0t^2} \quad A481$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.401155356.\frac{qa}{E_0t} \quad A482$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.199050949.\frac{qa}{E_0t} \quad A483$$

For square plate, $\beta = 1$, a/t = 40, $\theta = \mathbf{30^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.003766832.\frac{qa^4}{D_0} \quad A484$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 4.2335E-05.\frac{qa^3}{D_0} \quad A485$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 5.2831E-05.\frac{qa^3}{D_0} \quad A486$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00440322.\frac{qa^4}{E_0t^3} \quad A487$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -11.00197778.\frac{qa^3}{E_0t^2} \quad A488$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -10.93497106.\frac{qa^3}{E_0t^2} \quad A489$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.074051377.\frac{qa^2}{E_0t^2} \quad A490$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.215782055.\frac{qa^2}{E_0t^2} \quad A491$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.405399982.\frac{qa^2}{E_0t^2} \quad A492$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.202364022.\frac{qa}{E_0t} \quad A493$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.199050949.\frac{qa}{E_0t} \quad A494$$

For square plate, $\beta = 1$, a/t = 50, $\theta = 30^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.003733914.\frac{qa^4}{D_0} \quad A495$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 2.72282E-05.\frac{qa^3}{D_0} \quad A496$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 3.40735E-05.\frac{qa^3}{D_0} \quad A497$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.004364741.\frac{qa^4}{E_0t^3} \quad A498$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -17.18736483.\frac{qa^3}{E_0t^2} \quad A499$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -17.1190827.\frac{qa^3}{E_0t^2} \quad A500$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.397640626.\frac{qa^2}{E_0t^2} \quad A501$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.074361832.\frac{qa^2}{E_0t^2} \quad A502$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.215970695.\frac{qa^2}{E_0t^2} \quad A503$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.407401633.\frac{qa}{E_0t} \quad A504$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.203929926.\frac{qa}{E_0t} \quad A505$$

For square plate, $\beta = 1$, a/t = 60, $\theta = 30^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.003715866.\frac{qa^4}{D_0}$$ A506

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.89594E-05.\frac{qa^3}{D_0}$$ A507

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 2.37619E-05.\frac{qa^3}{D_0}$$ A508

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.004343645.\frac{qa^4}{E_0t^3}$$ A509

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = 0.397710649.\frac{qa^3}{E_0t^2}$$ A510

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = 0.074532102.\frac{qa^3}{E_0t^2}$$ A511

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.397640626.\frac{qa^2}{E_0t^2}$$ A512

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.074361832.\frac{qa^2}{E_0t^2}$$ A513

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.215970695.\frac{qa^2}{E_0t^2}$$ A514

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.408498992.\frac{qa}{E_0t}$$ A515

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.204789348.\frac{qa}{E_0t}$$ A516

For square plate, $\beta = 1$, a/t = 70, $\theta = 30^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.003704927.\frac{qa^4}{D_0}$$ A517

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.3952E-05.\frac{qa^3}{D_0}$$ A518

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 1.75021E-05.\frac{qa^3}{D_0}$$ A519

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.004330857.\frac{qa^4}{E_0t^3}$$ A520

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -33.68114192.\frac{qa^3}{E_0t^2}$$ A521

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -33.61173369.\frac{qa^3}{E_0t^2} \quad A522$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.397752791.\frac{qa^2}{E_0t^2} \quad A523$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.074635329.\frac{qa^2}{E_0t^2} \quad A524$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.21613848.\frac{qa^2}{E_0t^2} \quad A525$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.409164123.\frac{qa}{E_0t} \quad A526$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.205310585.\frac{qa}{E_0t} \quad A527$$

For square plate, $\beta = 1$, a/t = 80, $\theta = \mathbf{30^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.003697803.\frac{qa^4}{D_0} \quad A528$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.06933E-05.\frac{qa^3}{D_0} \quad A529$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 1.34222E-05.\frac{qa^3}{D_0} \quad A530$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00432253.\frac{qa^4}{E_0t^3} \quad A531$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -43.98964219.\frac{qa^3}{E_0t^2} \quad A532$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -43.9199568.\frac{qa^3}{E_0t^2} \quad A533$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.39778011.\frac{qa^2}{E_0t^2} \quad A534$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.074702555.\frac{qa^2}{E_0t^2} \quad A535$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.216179949.\frac{qa^2}{E_0t^2} \quad A536$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.40959722.\frac{qa}{E_0t} \quad A537$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.205650118.\frac{qa}{E_0t} \quad A538$$

For square plate, $\beta = 1$, a/t = 90, $\theta = \mathbf{30^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.003692909.\frac{qa^4}{D_0} \quad A539$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 8.45519E-06.\frac{qa^3}{D_0} \quad A540$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 1.06173E-05.\frac{qa^3}{D_0} \quad A541$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.004316809.\frac{qa^4}{E_0t^3} \quad A542$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -55.67257716.\frac{qa^3}{E_0t^2} \quad A543$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -55.60270125.\frac{qa^3}{E_0t^2} \quad A544$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.397798825.\frac{qa^2}{E_0t^2} \quad A545$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.074748749.\frac{qa^2}{E_0t^2} \quad A546$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.216208496.\frac{qa^2}{E_0t^2} \quad A547$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.40989479.\frac{qa}{E_0t} \quad A548$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.205883463.\frac{qa}{E_0t} \quad A549$$

For square plate, $\beta = 1$, a/t = 100, $\theta = \mathbf{30^o}$

$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.003689403.\frac{qa^4}{D_0}$ A550

$\phi_x = \left(\frac{k_8}{k_T}\right) P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 6.85226E-06 .\ \frac{qa^3}{D_0}$ A551

$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 8.60696E-06.\frac{qa^3}{D_0}$ A552

$w = \left(\frac{k_8}{k_T}\right) h\ .\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = 0.00431271.\frac{qa^4}{E_0t^3}$ A553

$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -68.72995528.\frac{qa^3}{E_0t^2}$ A554

$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -68.65994283.\frac{qa^3}{E_0t^2}$ A555

$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.397812204.\frac{qa^2}{E_0t^2}$ A556

$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.074781842.\frac{qa^2}{E_0t^2}$ A557

$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.216228973.\frac{qa^2}{E_0t^2}$ A558

$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} \quad = \quad 0.41010796.\frac{qa}{E_0t}$ A559

$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = 0.206050654.\frac{qa}{E_0t}$ A560

For square plate, $\beta = 1$, a/t = 5, $\theta = 45^o$

$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad 0.003689403.\frac{qa^4}{D_0}$ A561

$\phi_x = \left(\frac{k_8}{k_T}\right) P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 6.85226E-06 .\ \frac{qa^3}{D_0}$ A562

$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 8.60696E-06.\frac{qa^3}{D_0}$ A563

$w = \left(\frac{k_8}{k_T}\right) h\ .\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = 0.00431271.\frac{qa^4}{E_0t^3}$ A564

$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -68.72995528.\frac{qa^3}{E_0t^2}$ A565

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -68.65994283.\frac{qa^3}{E_0t^2} \quad A566$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.397812204.\frac{qa^2}{E_0t^2} \quad A567$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.074781842.\frac{qa^2}{E_0t^2} \quad A568$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.216228973.\frac{qa^2}{E_0t^2} \quad A569$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.41010796.\frac{qa}{E_0t} \quad A570$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.206050654.\frac{qa}{E_0t} \quad A571$$

For square plate, $\beta = 1$, a/t = 5, $\theta = \mathbf{45^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.005819568.\frac{qa^4}{D_0} \quad A572$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.000815431.\frac{qa^3}{D_0} \quad A573$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 0.00183352.\frac{qa^3}{D_0} \quad A574$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.006802757.\frac{qa^4}{E_0t^3} \quad A575$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -0.190770994.\frac{qa^3}{E_0t^2} \quad A576$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.089216638.\frac{qa^3}{E_0t^2} \quad A577$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.229241299.\frac{qa^2}{E_0t^2} \quad A578$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.067898964.\frac{qa^2}{E_0t^2} \quad A579$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.229042514.\frac{qa^2}{E_0t^2} \quad A580$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.122008938.\frac{qa}{E_0t} \quad A581$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.109736188.\frac{qa}{E_0t} \quad A582$$

For square plate, $\beta = 1$, $a/t = 10$, $\theta = 45^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.004451448.\frac{qa^4}{D_0} \quad A583$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.000359764.\frac{qa^3}{D_0} \quad A584$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 0.00087354.\frac{qa^3}{D_0} \quad A585$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.0052035.\frac{qa^4}{E_0t^3} \quad A586$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -0.689014034.\frac{qa^3}{E_0t^2} \quad A587$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.484017552.\frac{qa^3}{E_0t^2} \quad A588$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.236799286.\frac{qa^2}{E_0t^2} \quad A589$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.096364207.\frac{qa^2}{E_0t^2} \quad A590$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.239898189.\frac{qa^2}{E_0t^2} \quad A591$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.21531883.\frac{qa}{E_0t} \quad A592$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.209125421.\frac{qa}{E_0t} \quad A593$$

For square plate, $\beta = 1$, $a/t = 20$, $\theta = 45^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \;=\; 0.003639574.\frac{qa^4}{D_0} \qquad \text{A594}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \;=\; 0.000112952.\frac{qa^3}{D_0} \qquad \text{A595}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\;\frac{qa^3}{D_0} \;=\; 0.000280273.\frac{qa^3}{D_0} \qquad \text{A596}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \;=\; 0.004254462.\frac{qa^4}{E_0t^3} \qquad \text{A597}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \;=\; -2.542584789.\frac{qa^3}{E_0t^2} \qquad \text{A598}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \;=\; -2.275539744.\frac{qa^3}{E_0t^2} \qquad \text{A599}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.241001983.\frac{qa^2}{E_0t^2} \qquad \text{A600}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.113450294.\frac{qa^2}{E_0t^2} \qquad \text{A601}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.246340202.\frac{qa^2}{E_0t^2} \qquad \text{A602}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} \;=\; 0.270406726.\frac{qa}{E_0t} \qquad \text{A603}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \;=\; 0.268389717.\frac{qa}{E_0t} \qquad \text{A604}$$

For square plate, $\beta = 1$, $a/t = 30$, $\theta = 45^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \;=\; 0.003437528.\frac{qa^4}{D_0} \qquad \text{A605}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \;=\; 5.27432E-05.\frac{qa^3}{D_0} \qquad \text{A606}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\;\frac{qa^3}{D_0} \;=\; 0.000131418.\frac{qa^3}{D_0} \qquad \text{A607}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \;=\; 0.004018283.\frac{qa^4}{E_0t^3} \qquad \text{A608}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \;=\; -5.596926211.\frac{qa^3}{E_0t^2} \qquad \text{A609}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -5.314405473.\frac{qa^3}{E_0t^2} \quad A610$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.242033349.\frac{qa^2}{E_0t^2} \quad A611$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.117712367.\frac{qa^2}{E_0t^2} \quad A612$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.247943377.\frac{qa^2}{E_0t^2} \quad A613$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.284101403.\frac{qa}{E_0t} \quad A614$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.283153004.\frac{qa}{E_0t} \quad A615$$

For square plate, $\beta = 1$, a/t = 40, $\theta = \mathbf{45^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.003361583.\frac{qa^4}{D_0} \quad A616$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 3.02055E-05.\frac{qa^3}{D_0} \quad A617$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 7.53716E-05.\frac{qa^3}{D_0} \quad A618$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.003929506.\frac{qa^4}{E_0t^3} \quad A619$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -9.866704379.\frac{qa^3}{E_0t^2} \quad A620$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -9.578363924.\frac{qa^3}{E_0t^2} \quad A621$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.242419901.\frac{qa^2}{E_0t^2} \quad A622$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.119315188.\frac{qa^2}{E_0t^2} \quad A623$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.248545986.\frac{qa^2}{E_0t^2} \quad A624$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.289247895.\frac{qa}{E_0t} \quad A625$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.288703431.\frac{qa}{E_0t} \quad A626$$

For square plate, $\beta = 1$, a/t = 50, $\theta = 45^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.003325436.\frac{qa^4}{D_0} \quad A627$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.94952E-05.\frac{qa^3}{D_0} \quad A628$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 4.86793E-05.\frac{qa^3}{D_0} \quad A629$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.003887253.\frac{qa^4}{E_0t^3} \quad A630$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -15.35454563.\frac{qa^3}{E_0t^2} \quad A631$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -15.06343477.\frac{qa^3}{E_0t^2} \quad A632$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.242603683.\frac{qa^2}{E_0t^2} \quad A633$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.120078199.\frac{qa^2}{E_0t^2} \quad A634$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.248832802.\frac{qa^2}{E_0t^2} \quad A635$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.291697203.\frac{qa}{E_0t} \quad A636$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.291345399.\frac{qa}{E_0t} \quad A637$$

For square plate, $\beta = 1$, a/t = 60, $\theta = 45^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \;=\; 0.003305528.\frac{qa^4}{D_0} \qquad \text{A638}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \;=\; 1.3601E-05\,.\frac{qa^3}{D_0} \qquad \text{A639}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\;\frac{qa^3}{D_0} \;=\; 3.39739E-05.\frac{qa^3}{D_0} \qquad \text{A640}$$

$$w = \left(\frac{k_8}{k_T}\right) h\,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.003863981.\frac{qa^4}{E_0t^3} \qquad \text{A641}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\,P_2\,S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \;=\; -22.06116755.\frac{qa^3}{E_0t^2} \qquad \text{A642}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \;=\; -21.76853075.\frac{qa^3}{E_0t^2} \qquad \text{A643}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.242704849.\frac{qa^2}{E_0t^2} \qquad \text{A644}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.120498468.\frac{qa^2}{E_0t^2} \qquad \text{A645}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.248990767.\frac{qa^2}{E_0t^2} \qquad \text{A646}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} \;=\; 0.293046116.\frac{qa}{E_0t} \qquad \text{A647}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \;=\; 0.292800527.\frac{qa}{E_0t} \qquad \text{A648}$$

For square plate, $\beta = 1$, $a/t = 70$, $\theta = \mathbf{45^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \;=\; 0.003293429.\frac{qa^4}{D_0} \qquad \text{A649}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \;=\; 1.00205E-05\,.\frac{qa^3}{D_0} \qquad \text{A650}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\;\frac{qa^3}{D_0} \;=\; 2.50358E-05.\frac{qa^3}{D_0} \qquad \text{A651}$$

$$w = \left(\frac{k_8}{k_T}\right) h\,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.003849839.\frac{qa^4}{E_0t^3} \qquad \text{A652}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\,P_2\,S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \;=\; -29.98682694.\frac{qa^3}{E_0t^2} \qquad \text{A653}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -29.69326277.\frac{qa^3}{E_0t^2} \quad A654$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.242766309.\frac{qa^2}{E_0t^2} \quad A655$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.12075388.\frac{qa^2}{E_0t^2} \quad A656$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.249086764.\frac{qa^2}{E_0t^2} \quad A657$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.293865842.\frac{qa}{E_0t} \quad A658$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.293684837.\frac{qa}{E_0t} \quad A659$$

For square plate, $\beta = 1$, $a/t = 80$, $\theta = \mathbf{45^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.003285539.\frac{qa^4}{D_0} \quad A660$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 7.68589E-06.\frac{qa^3}{D_0} \quad A661$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 1.92057E-05.\frac{qa^3}{D_0} \quad A662$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.003840615.\frac{qa^4}{E_0t^3} \quad A663$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -39.13163358.\frac{qa^3}{E_0t^2} \quad A664$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -38.83746455.\frac{qa^3}{E_0t^2} \quad A665$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.242806387.\frac{qa^2}{E_0t^2} \quad A666$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.120920468.\frac{qa^2}{E_0t^2} \quad A667$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.249149374.\frac{qa^2}{E_0t^2} \quad A668$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.294400467.\frac{qa}{E_0t} \quad A669$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.294261599.\frac{qa}{E_0t} \quad A670$$

For square plate, $\beta = 1$, $a/t = 90$, $\theta = \mathbf{45^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.003280112.\frac{qa^4}{D_0} \quad A670$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 6.08039E-06.\frac{qa^3}{D_0} \quad A671$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 1.51953E-05.\frac{qa^3}{D_0} \quad A672$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.003834271.\frac{qa^4}{E_0t^3} \quad A673$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -49.49564061.\frac{qa^3}{E_0t^2} \quad A674$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -49.20105555.\frac{qa^3}{E_0t^2} \quad A675$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.24283395.\frac{qa^2}{E_0t^2} \quad A676$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.121035053.\frac{qa^2}{E_0t^2} \quad A677$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.249192438.\frac{qa^2}{E_0t^2} \quad A678$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.29476819.\frac{qa}{E_0t} \quad A679$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.294658312.\frac{qa}{E_0t} \quad A680$$

For square plate, $\beta = 1$, $a/t = 100$, $\theta = \mathbf{45^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.003276221.\frac{qa^4}{D_0} \qquad A681$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 4.92952E-06.\ \frac{qa^3}{D_0} \qquad A682$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 1.23201E-05.\frac{qa^3}{D_0} \qquad A683$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = 0.003829723.\frac{qa^4}{E_0t^3} \qquad A684$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -61.07887631.\frac{qa^3}{E_0t^2} \qquad A685$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -60.78399298.\frac{qa^3}{E_0t^2} \qquad A686$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.242853709.\frac{qa^2}{E_0t^2} \qquad A687$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.121117201.\frac{qa^2}{E_0t^2} \qquad A688$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.249223312.\frac{qa^2}{E_0t^2} \qquad A689$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} \quad = \quad 0.295031814.\frac{qa}{E_0t} \qquad A690$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = 0.294942724.\frac{qa}{E_0t} \qquad A691$$

For square plate, $\beta = 1$, $a/t = 5$, $\theta = \boldsymbol{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.007663341.\frac{qa^4}{D_0} \qquad A692$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 0.000496625.\ \frac{qa^3}{D_0} \qquad A693$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 0.002724257.\frac{qa^3}{D_0} \qquad A694$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = 0.008958027.\frac{qa^4}{E_0t^3} \qquad A695$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -0.308782716.\frac{qa^3}{E_0t^2} \qquad A696$$

$$v = 12\left[1-\mu_{xy}\mu_{yx}\right]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.086576463.\frac{qa^3}{E_0t^2} \quad A697$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.144820272.\frac{qa^2}{E_0t^2} \quad A698$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.067841665.\frac{qa^2}{E_0t^2} \quad A699$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.24889198.\frac{qa^2}{E_0t^2} \quad A670$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.074307552.\frac{qa}{E_0t} \quad A671$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.163046773.\frac{qa}{E_0t} \quad A672$$

For square plate, $\beta = 1$, a/t = 10, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.005504166.\frac{qa^4}{D_0} \quad A673$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.000243128.\frac{qa^3}{D_0} \quad A674$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 0.001241934.\frac{qa^3}{D_0} \quad A675$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12\left[1-\mu_{xy}\mu_{yx}\right]qa^4}{E_0t^3} = 0.00643407.\frac{qa^4}{E_0t^3} \quad A676$$

$$u = 12\left[1-\mu_{xy}\mu_{yx}\right]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -0.932443163.\frac{qa^3}{E_0t^2} \quad A677$$

$$v = 12\left[1-\mu_{xy}\mu_{yx}\right]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.533919486.\frac{qa^3}{E_0t^2} \quad A678$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.147495141.\frac{qa^2}{E_0t^2} \quad A679$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.139140305.\frac{qa^2}{E_0t^2} \quad A680$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.230781225.\frac{qa^2}{E_0t^2} \quad A681$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.145511962.\frac{qa}{E_0t} \quad A682$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.297318991.\frac{qa}{E_0t} \quad A683$$

For square plate, $\beta = 1$, a/t = 20, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.004252578.\frac{qa^4}{D_0} \quad A684$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 7.82642E-05.\frac{qa^3}{D_0} \quad A685$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 0.000391705.\frac{qa^3}{D_0} \quad A686$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.004971031.\frac{qa^4}{E_0t^3} \quad A687$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -3.056550051.\frac{qa^3}{E_0t^2} \quad A688$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -2.556298493.\frac{qa^3}{E_0t^2} \quad A689$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.149099418.\frac{qa^2}{E_0t^2} \quad A690$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.180072523.\frac{qa^2}{E_0t^2} \quad A691$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.220842379.\frac{qa^2}{E_0t^2} \quad A692$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.187364389.\frac{qa}{E_0t} \quad A693$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.37509669.\frac{qa}{E_0t} \quad A694$$

For square plate, $\beta = 1$, a/t = 30, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.003944578.\frac{qa^4}{D_0} \quad \text{A695}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 3.67021E-05.\frac{qa^3}{D_0} \quad \text{A696}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 0.000182973.\frac{qa^3}{D_0} \quad \text{A697}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.004610995.\frac{qa^4}{E_0t^3} \quad \text{A698}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -6.508036205.\frac{qa^3}{E_0t^2} \quad \text{A699}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -5.982777058.\frac{qa^3}{E_0t^2} \quad \text{A700}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.149497183.\frac{qa^2}{E_0t^2} \quad \text{A701}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.190123475.\frac{qa^2}{E_0t^2} \quad \text{A702}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.218427488.\frac{qa^2}{E_0t^2} \quad \text{A703}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.197695712.\frac{qa}{E_0t} \quad \text{A704}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.394233773.\frac{qa}{E_0t} \quad \text{A705}$$

For square plate, $\beta = 1$, $a/t = 40$, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.003829161.\frac{qa^4}{D_0} \quad \text{A706}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 2.10495E-05.\frac{qa^3}{D_0} \quad \text{A707}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 0.000104794.\frac{qa^3}{D_0} \quad \text{A708}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00447608.\frac{qa^4}{E_0t^3} \quad \text{A709}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -11.32438436.\frac{qa^3}{E_0t^2} \quad \text{A800}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -10.78975622.\frac{qa^3}{E_0t^2} \quad A801$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.149646472.\frac{qa^2}{E_0t^2} \quad A802$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.193888128.\frac{qa^2}{E_0t^2} \quad A803$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.217524996.\frac{qa^2}{E_0t^2} \quad A804$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.201569676.\frac{qa}{E_0t} \quad A805$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.401404753.\frac{qa}{E_0t} \quad A806$$

For square plate, $\beta = 1$, a/t = 50, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.003774296.\frac{qa^4}{D_0} \quad A807$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.35948E-05.\frac{qa^3}{D_0} \quad A808$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 6.7638E-05.\frac{qa^3}{D_0} \quad A809$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.004411945.\frac{qa^4}{E_0t^3} \quad A810$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -17.5121737.\frac{qa^3}{E_0t^2} \quad A811$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -16.97309223.\frac{qa^3}{E_0t^2} \quad A812$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.149717481.\frac{qa^2}{E_0t^2} \quad A813$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.195677409.\frac{qa^2}{E_0t^2} \quad A814$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.217096417.\frac{qa^2}{E_0t^2} \quad A815$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.20341168.\frac{qa}{E_0t} \quad A816$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.404813554.\frac{qa}{E_0t} \quad A817$$

For square plate, $\beta = 1$, a/t = 60, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.003744097.\frac{qa^4}{D_0} \quad A818$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 9.48787E-06.\frac{qa^3}{D_0} \quad A819$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 4.71885E-05.\frac{qa^3}{D_0} \quad A820$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.004376645.\frac{qa^4}{E_0t^3} \quad A821$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -25.07319173.\frac{qa^3}{E_0t^2} \quad A822$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -24.53165919.\frac{qa^3}{E_0t^2} \quad A823$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.149756576.\frac{qa^2}{E_0t^2} \quad A824$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.196662167.\frac{qa^2}{E_0t^2} \quad A825$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.216860639.\frac{qa^2}{E_0t^2} \quad A826$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.204425661.\frac{qa}{E_0t} \quad A827$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.406689787.\frac{qa}{E_0t} \quad A828$$

For square plate, $\beta = 1$, a/t = 70, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.003725752.\frac{qa^4}{D_0} \qquad A828$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 6.99169E-06\ \frac{qa^3}{D_0} \qquad A829$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 3.47663E-05.\frac{qa^3}{D_0} \qquad A830$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = 0.0043552.\frac{qa^4}{E_0 t^3} \qquad A831$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -34.00807661.\frac{qa^3}{E_0 t^2} \qquad A832$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -33.4650551.\frac{qa^3}{E_0 t^2} \qquad A833$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.14978033.\frac{qa^2}{E_0 t^2} \qquad A834$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.197260372.\frac{qa^2}{E_0 t^2} \qquad A835$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.216717446.\frac{qa^2}{E_0 t^2}$$

A836

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} \quad = \quad 0.205041688.\frac{qa}{E_0 t} \qquad A837$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3 - 4P_3 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = 0.40782958.\frac{qa}{E_0 t} \qquad A838$$

For square plate, $\beta = 1$, $a/t = 80$, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.00371379.\frac{qa^4}{D_0} \qquad A839$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 5.3635E-06\ \frac{qa^3}{D_0} \qquad A840$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 2.66665E-05.\frac{qa^3}{D_0} \qquad A841$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -44.31710077.\frac{qa^3}{E_0 t^2} \qquad A842$$

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -43.77310837.\frac{qa^3}{E_0t^2} \quad A843$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.004341217.\frac{qa^4}{E_0t^3} \quad A844$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.14979582.\frac{qa^2}{E_0t^2} \quad A845$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.197650428.\frac{qa^2}{E_0t^2} \quad A846$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.21662409.\frac{qa^2}{E_0t^2} \quad A847$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.205443393.\frac{qa}{E_0t} \quad A848$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.408572797.\frac{qa}{E_0t} \quad A849$$

For square plate, $\beta = 1$, a/t = 90, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.003705563.\frac{qa^4}{D_0} \quad A850$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 4.24352E-06\frac{qa^3}{D_0} \quad A851$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 2.10962E-05.\frac{qa^3}{D_0} \quad A852$$

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -56.00039605.\frac{qa^3}{E_0t^2} \quad A853$$

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -55.45573595.\frac{qa^3}{E_0t^2} \quad A854$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.004331601.\frac{qa^4}{E_0t^3} \quad A855$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.149806474.\frac{qa^2}{E_0t^2}$$

A856

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.197918673.\frac{qa^2}{E_0t^2} \quad \text{A857}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.216559896.\frac{qa^2}{E_0t^2} \quad \text{A858}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.205719662.\frac{qa}{E_0t} \quad \text{A859}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.409083921.\frac{qa}{E_0t} \quad \text{A860}$$

For square plate, $\beta = 1$, a/t = 100, $\theta = 60^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.003699666.\frac{qa^4}{D_0} \quad \text{A861}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 3.44056E-06\frac{qa^3}{D_0} \quad \text{A862}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 1.71032E-05.\frac{qa^3}{D_0} \quad \text{A863}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -69.05803246.\frac{qa^3}{E_0t^2} \quad \text{A864}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -68.51289374.\frac{qa^3}{E_0t^2} \quad \text{A865}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.004324707.\frac{qa^4}{E_0t^3} \quad \text{A866}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.149814112.\frac{qa^2}{E_0t^2} \quad \text{A867}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.198110958.\frac{qa^2}{E_0t^2} \quad \text{A868}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.216513882.\frac{qa^2}{E_0t^2} \quad \text{A869}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.205917706.\frac{q\alpha}{E_0 t} \quad A870$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.409450315.\frac{q\alpha}{E_0 t} \quad A871$$

For square plate, $\beta = 1$, $a/t = 5$, $\theta = 75^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{q\alpha^4}{D_0} = 0.014401866.\frac{q\alpha^4}{D_0} \quad A872$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.000572979.\frac{q\alpha^3}{D_0} \quad A873$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{q\alpha^3}{D_0} = 0.004857009.\frac{q\alpha^3}{D_0} \quad A874$$

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -0.616245108.\frac{q\alpha^3}{E_0 t^2} \quad A875$$

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.188913083.\frac{q\alpha^3}{E_0 t^2} \quad A876$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]q\alpha^4}{E_0 t^3} = 0.016834993.\frac{q\alpha^4}{E_0 t^3} \quad A877$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.123480325.\frac{q\alpha^2}{E_0 t^2} \quad A878$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.071039828.\frac{q\alpha^2}{E_0 t^2} \quad A879$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.203311524.\frac{q\alpha^2}{E_0 t^2} \quad A880$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.085731946.\frac{q\alpha}{E_0 t} \quad A881$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.290691993.\frac{q\alpha}{E_0 t} \quad A882$$

For square plate, $\beta = 1$, $a/t = 10$, $\theta = 75^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{q\alpha^4}{D_0} = 0.008710333.\frac{q\alpha^4}{D_0} \quad A883$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.000850618.\frac{q\alpha^3}{D_0} \quad A884$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 0.000170528.\frac{qa^3}{D_0} \qquad A885$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -1.561063741.\frac{qa^3}{E_0t^2} \qquad A886$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -0.851163434.\frac{qa^3}{E_0t^2} \qquad A887$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = 0.010181903.\frac{qa^4}{E_0t^3} \qquad A888$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\ \right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.097464099.\frac{qa^2}{E_0t^2}$$

A889

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\ \right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.224125495.\frac{qa^2}{E_0t^2} \qquad A890$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\ \right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.152278642.\frac{qa^2}{E_0t^2}$$

A891

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} \quad = \quad 0.102060998.\frac{qa}{E_0t} \qquad A892$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = 0.466764583.\frac{qa}{E_0t} \qquad A893$$

For square plate, $\beta = 1$, a/t = 20, $\theta = 75^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.00604104.\frac{qa^4}{D_0} \qquad A894$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 4.50662E-05.\frac{qa^3}{D_0} \qquad A895$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 0.000574312.\frac{qa^3}{D_0} \qquad A896$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -4.447527294.\frac{qa^3}{E_0t^2} \qquad A897$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -3.602850876.\frac{qa^3}{E_0t^2} \qquad A898$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = 0.007061645.\frac{qa^4}{E_0t^3} \qquad A899$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{11}.\Big[P_2-\frac{4}{3}P_2S^2-1\Big].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\Big[P_3-\frac{4}{3}P_3S^2-1\Big].\frac{\partial^2 h}{\partial Q^2}+$$
$$\frac{B_{13}}{\beta}.\Big[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\Big].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.084643802.\frac{qa^2}{E_0t^2}$$
A900

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{21}.\Big[P_2-\frac{4}{3}P_2S^2-1\Big].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\Big[P_3-\frac{4}{3}P_3S^2-1\Big].\frac{\partial^2 h}{\partial Q^2}+$$
$$\frac{B_{23}}{\beta}.\Big[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\Big].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.297179699.\frac{qa^2}{E_0t^2}$$ A901

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{31}.\Big[P_2-\frac{4}{3}P_2S^2-1\Big].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\Big[P_3-\frac{4}{3}P_3S^2-1\Big].\frac{\partial^2 h}{\partial Q^2}+$$
$$\frac{B_{33}}{\beta}.\Big[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\Big].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.127050705.\frac{qa^2}{E_0t^2}$$
A902

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.107888506.\frac{qa}{E_0t}$$ A903

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.549961253.\frac{qa}{E_0t}$$ A904

For square plate, $\beta = 1$, a/t = 30, $\theta = \mathbf{75^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.005439991.\frac{qa^4}{D_0}$$ A905

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 2.02546E-05.\frac{qa^3}{D_0}$$ A906

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 0.00026396.\frac{qa^3}{D_0}$$ A907

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\Big[P_2-\frac{4}{3}P_2S^2-1\Big].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -9.084300429.\frac{qa^3}{E_0t^2}$$ A908

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\Big[P_3-\frac{4}{3}P_3S^2-1\Big].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -8.209153807.\frac{qa^3}{E_0t^2}$$ A909

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.006359052.\frac{qa^4}{E_0t^3}$$ A910

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{11}.\Big[P_2-\frac{4}{3}P_2S^2-1\Big].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\Big[P_3-\frac{4}{3}P_3S^2-1\Big].\frac{\partial^2 h}{\partial Q^2}+$$
$$\frac{B_{13}}{\beta}.\Big[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\Big].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.081723407.\frac{qa^2}{E_0t^2}$$
A911

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{21}.\Big[P_2-\frac{4}{3}P_2S^2-1\Big].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\Big[P_3-\frac{4}{3}P_3S^2-1\Big].\frac{\partial^2 h}{\partial Q^2}+$$
$$\frac{B_{23}}{\beta}.\Big[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\Big].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.313697791.\frac{qa^2}{E_0t^2}$$ A912

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.121299784.\frac{qa^2}{E_0t^2}$$
A913

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.109101218.\frac{qa}{E_0t}$$ A914

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.56872846.\frac{qa}{E_0t}$$ A915

For square plate, $\beta = 1$, a/t = 40, $\theta = \mathbf{75^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.005219913.\frac{qa^4}{D_0}$$ A916

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.14388E-05.\frac{qa^3}{D_0}$$ A917

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 0.000150272.\frac{qa^3}{D_0}$$ A918

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -15.54756532.\frac{qa^3}{E_0t^2}$$ A919

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -14.66125227.\frac{qa^3}{E_0t^2}$$ A920

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1 - \mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.006101793.\frac{qa^4}{E_0t^3}$$ A921

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.080651456.\frac{qa^2}{E_0t^2}$$
A922

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.319751337.\frac{qa^2}{E_0t^2}$$ A923

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.119188549.\frac{qa^2}{E_0t^2}$$
A924

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.109537474.\frac{qa}{E_0t}$$ A925

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.575602818.\frac{qa}{E_0t}$$ A926

For square plate, $\beta = 1$, a/t = 50, $\theta = \mathbf{75^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.005116255.\frac{qa^4}{D_0} \quad A927$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 7.33444E-06.\frac{qa^3}{D_0} \quad A928$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 9.67153E-05.\frac{qa^3}{D_0} \quad A929$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -23.84932771.\frac{qa^3}{E_0 t^2} \quad A930$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -22.95775348.\frac{qa^3}{E_0 t^2} \quad A931$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} = 0.005980622.\frac{qa^4}{E_0 t^3} \quad A932$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.080146089.\frac{qa^2}{E_0 t^2} \quad A933$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 00.32260356.\frac{qa^2}{E_0 t^2} \quad A934$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.118193159.\frac{qa^2}{E_0 t^2} \quad A935$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.109741566.\frac{qa}{E_0 t} \quad A936$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.578841165.\frac{qa}{E_0 t} \quad A937$$

For square plate, $\beta = 1$, a/t = 60, $\theta = \mathbf{75^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.005059461.\frac{qa^4}{D_0} \quad A938$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 5.09853E-06.\frac{qa^3}{D_0} \quad A939$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 6.73693E-05.\frac{qa^3}{D_0} \quad A940$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -33.99274789.\frac{qa^3}{E_0 t^2} \quad A941$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -33.09829062.\frac{qa^3}{E_0t^2} \qquad A942$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.005980622.\frac{qa^4}{E_0t^3} \qquad A943$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.079869075.\frac{qa^2}{E_0t^2} \qquad A944$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.324166535.\frac{qa^2}{E_0t^2} \qquad A945$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.117647527.\frac{qa^2}{E_0t^2} \qquad A946$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.109853016.\frac{qa}{E_0t} \qquad A947$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.580615567.\frac{qa}{E_0t} \qquad A948$$

For square plate, $\beta = 1$, a/t = 70, $\theta = 75^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.005025049.\frac{qa^4}{D_0} \qquad A949$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 3.74816E-06.\frac{qa^3}{D_0} \qquad A950$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 4.95875E-05.\frac{qa^3}{D_0} \qquad A951$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -45.97893878.\frac{qa^3}{E_0t^2} \qquad A952$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -45.0827345.\frac{qa^3}{E_0t^2} \qquad A953$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.005874008.\frac{qa^4}{E_0t^3} \qquad A954$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.079701187.\frac{qa^2}{E_0t^2} \qquad A955$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.325113642.\frac{qa^2}{E_0t^2} \quad A956$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.117316834.\frac{qa^2}{E_0t^2} \quad A957$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.109920417.\frac{qa}{E_0t} \quad A958$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.581690735.\frac{qa}{E_0t} \quad A959$$

For square plate, $\beta = 1$, a/t = 80, $\theta = 75^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.005002647\frac{qa^4}{D_0} \quad A960$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 2.87083E-06.\frac{qa^3}{D_0}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 3.80111E-05.\frac{qa^3}{D_0} \quad A961$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -59.80837202.\frac{qa^3}{E_0t^2} \quad A962$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = 58.91103036.\frac{qa^3}{E_0t^2} \quad A963$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.005874008.\frac{qa^4}{E_0t^3} \quad A964$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.079701187.\frac{qa^2}{E_0t^2} \quad A965$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.325113642.\frac{qa^2}{E_0t^2} \quad A966$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.117316834.\frac{qa^2}{E_0t^2} \quad A967$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.109920417.\frac{qa}{E_0t} \quad A968$$

$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.581690735.\frac{qa}{E_0t}$ A969

For square plate, β = 1, a/t = 90, θ = 75^o

$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.004987257\frac{qa^4}{D_0}$ A970

$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 2.26893E-06.\frac{qa^3}{D_0}$ A971

$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 3.00583E-05.\frac{qa^3}{D_0}$ A972

$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -75.48127485.\frac{qa^3}{E_0t^2}$ A973

$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -74.58315182.\frac{qa^3}{E_0t^2}$ A974

$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.005829831.\frac{qa^4}{E_0t^3}$ A975

$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.079516771.\frac{qa^2}{E_0t^2}$ A976

$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.326153856.\frac{qa^2}{E_0t^2}$ A977

$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.116953581.\frac{qa^2}{E_0t^2}$ A978

$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.10999433.\frac{qa}{E_0t}$ A979

$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.582871552.\frac{qa}{E_0t}$ A980

For square plate, β = 1, a/t = 100, θ = 75^o

$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.004976233\frac{qa^4}{D_0}$ A981

$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.83819E-06.\frac{qa^3}{D_0}$ A982

$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 2.43616E-05.\frac{qa^3}{D_0}$ A983

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\,P_2\,S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -92.99776764.\frac{qa^3}{E_0t^2} \quad A984$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -92.09908489.\frac{qa^3}{E_0t^2} \quad A985$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.005816944.\frac{qa^4}{E_0t^3} \quad A986$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.079462971.\frac{qa^2}{E_0t^2} \quad A987$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.326457295.\frac{qa^2}{E_0t^2} \quad A988$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.116847607.\frac{qa^2}{E_0t^2} \quad A989$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.110015868.\frac{qa}{E_0t} \quad A990$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.583215996.\frac{qa}{E_0t} \quad A991$$

For square plate, $\beta = 1$, $a/t = 5$, $\theta = \mathbf{90^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.024497926\frac{qa^4}{D_0} \quad A992$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.000756882.\frac{qa^3}{D_0} \quad A993$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\,\frac{qa^3}{D_0} = 0.007968694.\frac{qa^3}{D_0} \quad A994$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\,P_2\,S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -1.0699705.\frac{qa^3}{E_0t^2} \quad A995$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = 0.350592232.\frac{qa^3}{E_0t^2} \quad A996$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.028636736.\frac{qa^4}{E_0t^3} \quad A997$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.139262383.\frac{qa^2}{E_0t^2} \quad A998$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.094631379.\frac{qa^2}{E_0t^2} \quad \text{A999}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.090916015.\frac{qa^2}{E_0t^2} \quad \text{A1000}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.113248395.\frac{qa}{E_0t} \quad \text{A1001}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.476926319.\frac{qa}{E_0t} \quad \text{A1002}$$

For square plate, $\beta = 1$, $a/t = 10$, $\theta = \mathbf{90^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.012059901\frac{qa^4}{D_0} \quad \text{A1003}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.00012004.\frac{qa^3}{D_0} \quad \text{A1004}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 0.00263552.\frac{qa^3}{D_0} \quad \text{A1005}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -2.207682326.\frac{qa^3}{E_0t^2} \quad \text{A1006}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -1.204005859.\frac{qa^3}{E_0t^2} \quad \text{A1007}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.014097365.\frac{qa^4}{E_0t^3} \quad \text{A1008}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.075449137.\frac{qa^2}{E_0t^2} \quad \text{A1009}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.312617812.\frac{qa^2}{E_0t^2} \quad \text{A1010}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.054587011.\frac{qa^2}{E_0t^2} \quad \text{A1011}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.071844067.\frac{qa}{E_0t} \quad \text{A1012}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.630943507.\frac{qa}{E_0 t} \quad \text{A1013}$$

For square plate, β = 1, a/t = 20, θ = 90°

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.007608678\frac{qa^4}{D_0} \quad \text{A1014}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 2.28721E-05.\frac{qa^3}{D_0} \quad \text{A1015}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 0.00071805.\frac{qa^3}{D_0}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -5.655738447.\frac{qa^3}{E_0 t^2} \quad \text{A1016}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = 4.546234889.\frac{qa^3}{E_0 t^2} \quad \text{A1017}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} = 0.008894129.\frac{qa^4}{E_0 t^3} \quad \text{A1018}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.051069904.\frac{qa^2}{E_0 t^2} \quad \text{A1019}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.392190094.\frac{qa^2}{E_0 t^2} \quad \text{A1020}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.040807893.\frac{qa^2}{E_0 t^2} \quad \text{A1021}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.054755817.\frac{qa}{E_0 t} \quad \text{A1021}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.687604462.\frac{qa}{E_0 t} \quad \text{A1022}$$

For square plate, β = 1, a/t = 30, θ = 90°

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.006696259\frac{qa^4}{D_0} \quad \text{A1023}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 9.494E-06.\frac{qa^3}{D_0} \quad \text{A1024}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 0.00032456.\frac{qa^3}{D_0} \qquad A1025$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\, S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -11.23759446.\frac{qa^3}{E_0 t^2} \qquad A1026$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -10.10619398.\frac{qa^3}{E_0 t^2} \qquad A1027$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = 0.007827561.\frac{qa^4}{E_0 t^3} \qquad A1028$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.045995465.\frac{qa^2}{E_0 t^2} \qquad A1029$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.408579032.\frac{qa^2}{E_0 t^2} \qquad A1030$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.037944513.\frac{qa^2}{E_0 t^2} \qquad A1031$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} \quad = \quad 0.051139455.\frac{qa}{E_0 t} \qquad A1032$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = 0.699296072.\frac{qa}{E_0 t} \qquad A1033$$

For square plate, $\beta = 1$, a/t = 40, $\theta = \mathbf{90^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.00636962\,\frac{qa^4}{D_0} \qquad A1034$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 5.20428E-06.\frac{qa^3}{D_0} \qquad A1035$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 0.000183659.\frac{qa^3}{D_0} \qquad A1035$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\, S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -19.02786283.\frac{qa^3}{E_0 t^2} \qquad A1036$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -17.8886078.\frac{qa^3}{E_0 t^2} \qquad A1037$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = 0.007445737.\frac{qa^4}{E_0 t^3} \qquad A1038$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.04417296.\frac{qa^2}{E_0t^2} \quad A1039$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.414452118.\frac{qa^2}{E_0t^2} \quad A1039$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.036916471.\frac{qa^2}{E_0t^2} \quad A1040$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.049836147.\frac{qa}{E_0t} \quad A1041$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.703487478.\frac{qa}{E_0t} \quad A1042$$

For square plate, β = 1, a/t = 50, θ = 90°

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.006217117\frac{qa^4}{D_0} \quad A1043$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 3.28997E-06.\frac{qa^3}{D_0} \quad A1044$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 0.000117869.\frac{qa^3}{D_0} \quad A1045$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -29.03706289.\frac{qa^3}{E_0t^2} \quad A1046$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -27.89413794.\frac{qa^3}{E_0t^2} \quad A1047$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00726747.\frac{qa^4}{E_0t^3} \quad A1048$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.043321019.\frac{qa^2}{E_0t^2} \quad A1049$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.41719522.\frac{qa^2}{E_0t^2} \quad A1050$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.036435969.\frac{qa^2}{E_0t^2} \quad A1051$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.049226117.\frac{qa}{E_0 t}$$ A1052

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.705445419.\frac{qa}{E_0 t}$$ A1053

For square plate, $\beta = 1$, a/t = 60, $\theta = \mathbf{90^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.006133924\frac{qa^4}{D_0}$$ A1054

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 2.26923E-06.\frac{qa^3}{D_0}$$ A1055

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 8.19774E-05.\frac{qa^3}{D_0}$$ A1056

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -41.26788078.\frac{qa^3}{E_0t^2}$$ A1057

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -40.12295307.\frac{qa^3}{E_0t^2}$$ A1058

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.007170222.\frac{qa^4}{E_0t^3}$$ A1059

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.042855989.\frac{qa^2}{E_0t^2}$$ A1060

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.418691923.\frac{qa^2}{E_0t^2}$$ A1061

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.036173704.\frac{qa^2}{E_0t^2}$$ A1062

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.048892924.\frac{qa}{E_0 t}$$ A1063

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.706513797.\frac{qa}{E_0 t}$$ A1064

For square plate, $\beta = 1$, a/t = 70, $\theta = \mathbf{90^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.00608364\frac{qa^4}{D_0}$$ A1065

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2 . \frac{\partial h}{\partial R} . \frac{qa^3}{D_0} \quad = \quad 1.66032E-06. \frac{qa^3}{D_0} \qquad A1066$$

$$\phi_y = \left(\frac{k_8}{k_T}\right) \frac{P_3}{\beta} . \frac{\partial h}{\partial Q} \frac{qa^3}{D_0} \quad = \quad 6.02833E-05. \frac{qa^3}{D_0} \qquad A1067$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . S . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} . \frac{qa}{E_0} \quad = \quad -55.72125024. \frac{qa^3}{E_0 t^2} \qquad A1068$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{S}{\beta} . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial Q} . \frac{qa}{E_0} \quad = \quad -54.57511178. \frac{qa^3}{E_0 t^2} \qquad A1069$$

$$w = \left(\frac{k_8}{k_T}\right) h . \frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = 0.007111443. \frac{qa^4}{E_0 t^3} \qquad A1070$$

$$\sigma_R = 12qS . \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \left(B_{11} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\right) = 0.042574822. \frac{qa^2}{E_0 t^2} \qquad A1071$$

$$\sigma_Q = 12qS . \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \left(B_{21} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\right) = 0.419596653. \frac{qa^2}{E_0 t^2} \qquad A1072$$

$$\tau_{RQ} = 12qS . \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \left(B_{31} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\right) = 0.036015139. \frac{qa^2}{E_0 t^2} \qquad A1073$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2) . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} \quad = \quad 0.048691396. \frac{qa}{E_0 t} \qquad A1074$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2) . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial Q} \quad = \quad 0.707159638. \frac{qa}{E_0 t} \qquad A1075$$

For square plate, $\beta = 1$, a/t = 80, $\theta = 90^o$

$$A_1 = \left(\frac{k_8}{k_T}\right) \frac{qa^4}{D_0} \quad = \quad 0.006050956 \frac{qa^4}{D_0} \qquad A1076$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2 . \frac{\partial h}{\partial R} . \frac{qa^3}{D_0} \quad = \quad 1.26776E-06. \frac{qa^3}{D_0} \qquad A1077$$

$$\phi_y = \left(\frac{k_8}{k_T}\right) \frac{P_3}{\beta} . \frac{\partial h}{\partial Q} \frac{qa^3}{D_0} \quad = \quad 4.61818E-05. \frac{qa^3}{D_0} \qquad A1078$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . S . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} . \frac{qa}{E_0} \quad = \quad -72.39756428. \frac{qa^3}{E_0 t^2} \qquad A1079$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{S}{\beta} . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial Q} . \frac{qa}{E_0} \quad = \quad 71.25063872. \frac{qa^3}{E_0 t^2} \qquad A1080$$

$$w = \left(\frac{k_8}{k_T}\right) h . \frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = 0.007073236. \frac{qa^4}{E_0 t^3} \qquad A1081$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.042392023.\frac{qa^2}{E_0t^2} \quad \text{A1082}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.420184773.\frac{qa^2}{E_0t^2} \quad \text{A1083}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.035912051.\frac{qa^2}{E_0t^2} \quad \text{A1084}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.048560345.\frac{qa}{E_0t} \quad \text{A1085}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.707579478.\frac{qa}{E_0t} \quad \text{A1086}$$

For square plate, $\beta = 1$, $a/t = 90$, $\theta = \mathbf{90^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.006028525\frac{qa^4}{D_0} \quad \text{A1087}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 9.99833E-07.\frac{qa^3}{D_0} \quad \text{A1087}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 3.65042E-05.\frac{qa^3}{D_0} \quad \text{A1088}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -91.2970115.\frac{qa^3}{E_0t^2} \quad \text{A1089}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -90.14954571.\frac{qa^3}{E_0t^2} \quad \text{A1090}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.007047016.\frac{qa^4}{E_0t^3} \quad \text{A1091}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.042266555.\frac{qa^2}{E_0t^2} \quad \text{A1092}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.420588403.\frac{qa^2}{E_0t^2} \quad \text{A1093}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.035841295.\frac{qa^2}{E_0t^2} \quad \text{A1094}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.048470382.\frac{qa}{E_0t} \quad \text{A1095}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.707867621.\frac{qa}{E_0t} \quad \text{A1096}$$

For square plate, $\beta = 1$, $a/t = 100$, $\theta = 90^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.006012469\frac{qa^4}{D_0} \quad \text{A1097}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 8.08788E-07.\frac{qa^3}{D_0} \quad \text{A1098}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\;\frac{qa^3}{D_0} = 2.9577E-05.\frac{qa^3}{D_0} \quad \text{A1099}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -112.4196915.\frac{qa^3}{E_0t^2} \quad \text{A1100}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -111.271839.\frac{qa^3}{E_0t^2} \quad \text{A1101}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.007028248.\frac{qa^4}{E_0t^3} \quad \text{A1102}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.042176737.\frac{qa^2}{E_0t^2} \quad \text{A1103}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.420877326.\frac{qa^2}{E_0t^2} \quad \text{A1104}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.035790645.\frac{qa^2}{E_0t^2} \quad \text{A1105}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.048405975.\frac{qa}{E_0t} \quad \text{A1106}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.70807388.\frac{qa}{E_0t} \quad \text{A1107}$$

APPENDIX B

Example problem of typical anisotropic rectangular thick plate (CCCC boundary condition)

Analyze an orthotropic thick square CCCC plate with the following information:
$E_1 = 25$; $E_2 = 1$; $G_{12} = 0.5$; $G_{13} = 0.5$; $G_{23} = 0.2$, $\mu_{12} = 0.25$ (from section 3.6.2).
Solution

$$h = (R^2 - 2R^3 + R^4)(Q^3 - 2Q^3 + Q^4) \quad \text{B1}$$

$$H = S - \frac{4}{3}S^3 \quad \text{B2}$$

$$E_0 = E_2 = 1 \quad \text{B3}$$

$$g_2 = \frac{4}{5};\ \ g_3 = \frac{68}{105};\ g_4 = 6.4;\quad \mu_{21} = \mu_2 = \frac{E_2}{E_1}\mu_{12} = 0.01 \quad \text{B4}$$

$$E_{11} = E_1 \ \ and\ d_{11} = \frac{E_{11}}{E_0} = \frac{E_{11}}{1} = 25 \quad \text{B5}$$

$$E_{12} = E_2 \,.\mu_{12}\ \ and\ d_{12} = \frac{E_{12}}{E_0} = \frac{E_2\,.\mu_{12}}{1} = \frac{1\times 0.25}{1} = 0.25 \quad \text{B6}$$

$$E_{21} = E_1 \,.\mu_{21}\ and\ d_{21} = \frac{E_{21}}{E_0} = \frac{E_1\,.\mu_{21}}{1} = \frac{25\times 0.01}{E_0} = 0.25 \quad \text{B7}$$

$$E_{22} = E_2 \ \ and\ d_{22} = \frac{E_{22}}{E_0} = \frac{1}{1} = 1 \quad \text{B8}$$

$$E_{33} = G_{12}(1 - \mu_{12}\mu_{21}) \quad and\ d_{33} = \frac{E_{33}}{E_0} = \frac{G_{12}(1-\mu_{12}\mu_{21})}{1} = \frac{0.5\times(1-0.25\times 0.01)}{1} = 0.49875 \quad \text{B9}$$

$$E_{44} = G_{13}(1 - \mu_{12}\mu_{21}) \quad and\ d_{44} = \frac{E_{44}}{E_0} = \frac{G_{13}(1-\mu_{12}\mu_{21})}{1} = \frac{0.5\times(1-0.25\times 0.01)}{1} = 0.49875 \quad \text{B10}$$

$$E_{55} = G_{23}(1 - \mu_{12}\mu_{21})\ and\ d_{55} = \frac{E_{55}}{E_0} = \frac{G_{23}(1-\mu_{12}\mu_{21})}{1} = \frac{0.2\times(1-0.25\times 0.01)}{1} = 0.1995 \quad \text{B11}$$

Constitutive relations

Angle of orientation $\theta = \mathbf{0^o}$

$$B_{11} = m^4 d_{11} + 2m^2n^2(d_{12} + 2d_{33}) + n^4 d_{22} \ = \ 25 \quad \text{B12}$$

$$B_{12} = d_{12}(n^4 + m^4) + m^2n^2(d_{11} + d_{22} - 4d_{33}) \ = \ 0.25 \quad \text{B13}$$

$$B_{13} = m^3n(d_{11} - d_{12} - 2d_{33}) + mn^3(d_{12} - d_{22} + 2d_{33}) \ = \ 0 \quad \text{B14}$$

$$B_{22} = n^4 d_{11} + 2m^2 n^2 (d_{12} + 2d_{33}) + m^4 d_{22} \;\; = \;\; 1 \qquad \text{B15}$$

$$B_{23} = mn^3 d_{11} - m^3 n d_{22} + (m^3 n - mn^3)(d_{12} + 2d_{33}) \;\; = 0 \qquad \text{B16}$$

$$B_{33} = m^2 n^2 (d_{11} - 2d_{12} + d_{22} - 2d_{33}) + d_{33}(m^4 + n^4) \;\; = 0.49875 \qquad \text{B17}$$

$$B_{21} = B_{12},\; B_{31} = B_{13} \;\; and \;\; B_{32} = B_{23} \qquad \text{B18}$$

$$B_{44} = d_{44} \;\; = 0.49875 \qquad \text{B19}$$

$$B_{55} = d_{55} \;\;\; = 0.1995 \qquad \text{B20}$$

$k_1 = 0.00126; k_2 = 0.00036;\; k_3 = 0.00127; k_4 = 0; k_5 = 0; k_6 = 0.00003; k_7 = 0.00003$
$k_8 = 0.00111$ B21

For square plate, β = 1.5, a/t = 5, θ = $\mathbf{0^o}$

$$L_{11} = g_3 \mathrm{B}_{11} k_1 + \frac{\mathrm{B}_{33}}{\beta^2} g_3 k_2 + 2\frac{B_{13}}{\beta} g_3 k_4 + \mathrm{B}_{44}.\left(\frac{a}{t}\right)^2 . g_4 . k_6 \;\; = \;\; 0.023024117 \qquad \text{B22}$$

$$L_{12} = (\mathrm{B}_{12} + \mathrm{B}_{33}) \frac{g_3}{\beta^2} k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 \;\; = \;\; 7.81907\mathrm{E} - 05 \qquad \text{B23}$$

$$L_{13} = (\mathrm{B}_{11} + 0.5\mathrm{B}_{12}) g_2 k_1 + (0.5\mathrm{B}_{12} + \mathrm{B}_{33}) \frac{g_2}{\beta^2} k_2 + 3\frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 \;\; = \;\; 0.025604273 \qquad \text{B24}$$

$$L_{21} = (\mathrm{B}_{12} + \mathrm{B}_{33}) \frac{g_3}{\beta^2} . k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 \;\; = \;\; 7.81907\text{E-}05 \qquad \text{B25}$$

$$L_{22} = \frac{\mathrm{B}_{22}}{\beta^4} g_3 k_3 + 2\frac{B_{23}}{\beta^3} g_3 k_5 + \frac{\mathrm{B}_{33}}{\beta^2} g_3 k_2 + \frac{\mathrm{B}_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2 . g_4 k_7 \;\; = 0.000643452 \qquad \text{B26}$$

$$L_{23} = (0.5\mathrm{B}_{12} + \mathrm{B}_{33}) \frac{g_2}{\beta^2} k_2 + (0.5\mathrm{B}_{12} + \mathrm{B}_{22}) \frac{g_2}{\beta^4} k_3 + \frac{B_{13}}{\beta} g_2 k_4 + 3\frac{B_{23}}{\beta^3} g_2 k_5 \;\; = 0.000306213 \qquad \text{B27}$$

$$L_{31} = (\mathrm{B}_{11} + 0.5\mathrm{B}_{12}) g_2 k_1 + (0.5\mathrm{B}_{12} + \mathrm{B}_{33}) \frac{g_2}{\beta^2} k_2 + 3\frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 \;\; = \;\; 0.025604273 \qquad \text{B28}$$

$$L_{32} = (0.5\mathrm{B}_{12} + \mathrm{B}_{33}) \frac{g_2}{\beta^2} k_2 + (0.5\mathrm{B}_{12} + \mathrm{B}_{22}) \frac{g_2}{\beta^4} k_3 + \frac{B_{13}}{\beta} g_2 k_4 + 3\frac{B_{23}}{\beta^3} g_2 k_5 \;\; = \;\; 0.000306213 \qquad \text{B29}$$

$$\mathrm{P}_2 = \frac{(L_{12}.L_{23} - L_{13}.L_{22})}{({L_{12}}^2 - L_{11} L_{22})} \;\; = \;\; 1.110905502 \qquad \text{B30}$$

$$\mathrm{P}_3 = \frac{(L_{12}.L_{13} - L_{11} L_{23})}{({L_{12}}^2 - L_{11} L_{22})} \;\; = \;\; 0.340896679 \qquad \text{B31}$$

$$k_{T1} = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 \quad = \quad 0.003391491 \qquad B32$$

$$k_{T2} = \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 = 0.000285501 \qquad B33$$

$$k_{T3} = \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 \quad = 0.000173876 \qquad B34$$

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 \quad = \quad 0 \qquad B35$$

$$k_{T5} = \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 \quad = \quad 0 \qquad B36$$

$$k_T = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 + \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 + \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 + \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 = k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = \quad 0.003850868 \qquad B37$$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.2885353.\frac{qa^4}{D_0} \qquad B38$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 0.003846425.\frac{qa^3}{D_0} \qquad B39$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 0.000786886.\frac{qa^3}{D_0} \qquad B40$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.01349.\ \frac{qa^4}{E_0t^3} \qquad B41$$

$$\text{Where } D_0 = \quad \frac{E_0t^3}{12[1-\mu_{xy}\mu_{yx}]} \qquad B42$$

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -0.13438.\frac{qa^3}{E_0t^2} \qquad B43$$

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -0.26688.\frac{qa^3}{E_0t^2} \qquad B44$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = \quad -0.02330.\frac{qa^2}{E_0t^2} \qquad B45$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = \quad -0.00145.\frac{qa^2}{E_0t^2} \qquad B46$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.03285.\frac{qa^2}{E_0t^2} \qquad B47$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.57552\,.\frac{qa}{E_0 t} \quad \text{B48}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.04710.\frac{qa}{E_0 t} \quad \text{B49}$$

For square plate, $\beta = 1.5$, $a/t = 10$, $\theta = \mathbf{0^o}$

$$L_{11} = g_3 B_{11} k_1 + \frac{B_{33}}{\beta^2} g_3 k_2 + 2\frac{B_{13}}{\beta} g_3 k_4 + B_{44}.\left(\frac{a}{t}\right)^2.g_4.k_6 = 0.030262212 \quad \text{B50}$$

$$L_{12} = (B_{12} + B_{33})\frac{g_3}{\beta^2} k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 = 7.81907E-05 \quad \text{B51}$$

$$L_{13} = (B_{11} + 0.5B_{12}) g_2 k_1 + (0.5B_{12} + B_{33})\frac{g_2}{\beta^2} k_2 + 3\frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 = 0.025604273 \quad \text{B52}$$

$$L_{21} = (B_{12} + B_{33})\frac{g_3}{\beta^2}.k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 = 7.81907E-05 \quad \text{B53}$$

$$L_{22} = \frac{B_{22}}{\beta^4} g_3 k_3 + 2\frac{B_{23}}{\beta^3} g_3 k_5 + \frac{B_{33}}{\beta^2} g_3 k_2 + \frac{B_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2.g_4 k_7 = 0.001930224 \quad \text{B54}$$

$$L_{23} = (0.5B_{12} + B_{33})\frac{g_2}{\beta^2} k_2 + (0.5B_{12} + B_{22})\frac{g_2}{\beta^4} k_3 + \frac{B_{13}}{\beta} g_2 k_4 + 3\frac{B_{23}}{\beta^3} g_2 k_5 = 0.000306213 \quad \text{B55}$$

$$L_{31} = (B_{11} + 0.5B_{12}) g_2 k_1 + (0.5B_{12} + B_{33})\frac{g_2}{\beta^2} k_2 + 3\frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 = 0.025604273 \quad \text{B56}$$

$$L_{32} = (0.5B_{12} + B_{33})\frac{g_2}{\beta^2} k_2 + (0.5B_{12} + B_{22})\frac{g_2}{\beta^4} k_3 + \frac{B_{13}}{\beta} g_2 k_4 + 3\frac{B_{23}}{\beta^3} g_2 k_5 = 0.000306213 \quad \text{B57}$$

$$P_2 = \frac{(L_{12}.L_{23} - L_{13}.L_{22})}{(L_{12}{}^2 - L_{11}L_{22})} = 0.845759311 \quad \text{B58}$$

$$P_3 = \frac{(L_{12}.L_{13} - L_{11}L_{23})}{(L_{12}{}^2 - L_{11}L_{22})} = 0.124380669 \quad \text{B59}$$

$$k_{T1} = [B_{11} - B_{11} g_2 P_2 - 0.5B_{12} g_2 P_2] k_1 = 0.010159032 \quad \text{B60}$$

$$k_{T2} = \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2 P_2 - g_2 P_3] k_2 = 0.000324257 \quad \text{B61}$$

$$k_{T3} = \frac{1}{\beta^4}[B_{22} - B_{22} g_2 P_3 - 0.5B_{12} g_2 P_3] k_3 = 0.000222754 \quad \text{B62}$$

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2 P_2 - g_2 P_3] k_4 = 0 \quad \text{B63}$$

$$k_{T5} = \frac{B_{23}}{\beta^3}.[4 - g_2 P_2 - 3g_2 P_3] k_5 = 0 \quad \text{B64}$$

$$k_T = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 + \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 +$$
$$\frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 + \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 =$$
$$k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = 0.010706043 \quad \text{B65}$$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.103783545.\frac{qa^4}{D_0} \quad \text{B66}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.001053311.\frac{qa^3}{D_0} \quad \text{B67}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 0.000103269.\frac{qa^3}{D_0} \quad \text{B68}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00485.\frac{qa^4}{E_0t^3} \quad \text{B69}$$

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -0.32510.\frac{qa^3}{E_0t^2} \quad \text{B70}$$

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.45571.\frac{qa^3}{E_0t^2} \quad \text{B71}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} +\right.$$
$$\left.\frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = -0.01404.\frac{qa^2}{E_0t^2} \quad \text{B72}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} +\right.$$
$$\left.\frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = -0.00066.\frac{qa^2}{E_0t^2} \quad \text{B73}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} +\right.$$
$$\left.\frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.01549.\frac{qa^2}{E_0t^2} \quad \text{B74}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.63041.\frac{qa}{E_0t} \quad \text{B75}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.02472.\frac{qa}{E_0t} \quad \text{B76}$$

For square plate, $\beta = 1.5$, $a/t = 20$, $\theta = \mathbf{0^o}$

$$L_{11} = g_3B_{11}k_1 + \frac{B_{33}}{\beta^2}g_3k_2 + 2\frac{B_{13}}{\beta}g_3k_4 + B_{44}.\left(\frac{a}{t}\right)^2.g_4.k_6 = 0.059214593 \quad \text{B77}$$
$$L_{12} = (B_{12} + B_{33})\frac{g_3}{\beta^2}k_2 + \frac{B_{13}}{\beta}g_3k_4 + \frac{B_{23}}{\beta^3}g_3k_5 = 7.81907E-05 \quad \text{B78}$$

$$L_{13} = (B_{11} + 0.5B_{12})g_2k_1 + (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + 3\frac{B_{13}}{\beta}g_2k_4 + \frac{B_{23}}{\beta^3}g_2k_5 = 0.025604273 \quad \text{B79}$$

$$L_{21} = (B_{12} + B_{33})\frac{g_3}{\beta^2}.k_2 + \frac{B_{13}}{\beta}g_3k_4 + \frac{B_{23}}{\beta^3}g_3k_5 = 7.81907E-05 \quad \text{B80}$$

$$L_{22} = \frac{B_{22}}{\beta^4}g_3k_3 + 2\frac{B_{23}}{\beta^3}g_3k_5 + \frac{B_{33}}{\beta^2}g_3k_2 + \frac{B_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2.g_4k_7 = 0.007077314 \quad \text{B81}$$

$$L_{23} = (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + (0.5B_{12} + B_{22})\frac{g_2}{\beta^4}k_3 + \frac{B_{13}}{\beta}g_2k_4 + 3\frac{B_{23}}{\beta^3}g_2k_5 = 0.000306213 \quad \text{B82}$$

$$L_{31} = (B_{11} + 0.5B_{12})g_2k_1 + (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + 3\frac{B_{13}}{\beta}g_2k_4 + \frac{B_{23}}{\beta^3}g_2k_5 = 0.025604273 \quad \text{B83}$$

$$L_{32} = (0.5B_{12} + B_{33})\frac{g_2}{\beta^2}k_2 + (0.5B_{12} + B_{22})\frac{g_2}{\beta^4}k_3 + \frac{B_{13}}{\beta}g_2k_4 + 3\frac{B_{23}}{\beta^3}g_2k_5 = 0.000306213 \quad \text{B84}$$

$$P_2 = \frac{(L_{12}.L_{23} - L_{13}.L_{22})}{(L_{12}{}^2 - L_{11}L_{22})} = 0.4323472 \quad \text{B85}$$

$$P_3 = \frac{(L_{12}.L_{13} - L_{11}L_{23})}{(L_{12}{}^2 - L_{11}L_{22})} = 0.038490251 \quad \text{B86}$$

$$k_{T1} = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 = 0.020710884 \quad \text{B87}$$

$$k_{T2} = \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 = 0.000364433 \quad \text{B88}$$

$$k_{T3} = \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 = 0.000242144 \quad \text{B89}$$

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 = 0 \quad \text{B90}$$

$$k_{T5} = \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 = 0 \quad \text{B91}$$

$$k_T = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 + \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 + \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 + \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 = k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = 0.021317461 \quad \text{B92}$$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.052122114.\frac{qa^4}{D_0} \quad \text{B93}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.000270418.\frac{qa^3}{D_0} \quad \text{B94}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 1.60495E-05.\frac{qa^3}{D_0} \quad \text{B95}$$

$$w = \left(\frac{k_8}{k_T}\right) h . \frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = \quad 0.00244. \frac{qa^4}{E_0 t^3} \qquad \text{B96}$$

$$u = 12[1-\mu_{xy}\mu_{yx}] \left(\frac{a}{t}\right)^2 \left[P_2 - \frac{4}{3}\ P_2\, S^2 - 1\right] . S. \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} . \frac{qa}{E_0} \quad = \quad -1.06578. \frac{qa^3}{E_0 t^2} \qquad \text{B97}$$

$$v = 12[1-\mu_{xy}\mu_{yx}] \left(\frac{a}{t}\right)^2 \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{S}{\beta} . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial Q} . \frac{qa}{E_0} \quad = \quad -0.97263. \frac{qa^3}{E_0 t^2} \qquad \text{B98}$$

$$\sigma_R = 12qS. \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \left(B_{11} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\right) \quad = \quad -0.01147. \frac{qa^2}{E_0 t^2} \qquad \text{B99}$$

$$\sigma_Q = 12qS. \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \left(B_{21} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\right) \quad = \quad -0.00039. \frac{qa^2}{E_0 t^2} \qquad \text{B100}$$

$$\tau_{RQ} = 12qS. \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \left(B_{31} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\right) \quad = \quad 0.00969. \frac{qa^2}{E_0 t^2} \qquad \text{B101}$$

$$\tau_{RS} = 12q \left(\frac{a}{t}\right)^3 B_{44} (P_2 - 4P_2 S^2) . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} \quad = \quad 0.64738. \frac{qa}{E_0 t} \qquad \text{B102}$$

$$\tau_{QS} = 12q \left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta} (P_3 - 4P_3 S^2) . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial Q} \quad = \quad 0.01537. \frac{qa}{E_0 t} \qquad \text{B103}$$

For square plate, $\beta = 1$, $a/t = 30$, $\theta = \mathbf{0^o}$

$$L_{11} = g_3 B_{11} k_1 + \frac{B_{33}}{\beta^2} g_3 k_2 + 2\frac{B_{13}}{\beta} g_3 k_4 + B_{44} . \left(\frac{a}{t}\right)^2 . g_4 . k_6 \quad = \quad 0.107468562 \qquad \text{B104}$$

$$L_{12} = (B_{12} + B_{33}) \frac{g_3}{\beta^2} k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 \quad = \quad 7.81907\text{E}-05 \qquad \text{B105}$$

$$L_{13} = (B_{11} + 0.5B_{12}) g_2 k_1 + (0.5B_{12} + B_{33}) \frac{g_2}{\beta^2} k_2 + 3\frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 \quad = \quad 0.025604273 \qquad \text{B106}$$

$$L_{21} = (B_{12} + B_{33}) \frac{g_3}{\beta^2} . k_2 + \frac{B_{13}}{\beta} g_3 k_4 + \frac{B_{23}}{\beta^3} g_3 k_5 \quad = \quad 7.81907\text{E}-05 \qquad \text{B107}$$

$$L_{22} = \frac{B_{22}}{\beta^4} g_3 k_3 + 2\frac{B_{23}}{\beta^3} g_3 k_5 + \frac{B_{33}}{\beta^2} g_3 k_2 + \frac{B_{55}}{\beta^2} . \left(\frac{a}{t}\right)^2 . g_4 k_7 \quad = \quad 0.015655798 \qquad \text{B108}$$

$$L_{23} = (0.5B_{12} + B_{33}) \frac{g_2}{\beta^2} k_2 + (0.5B_{12} + B_{22}) \frac{g_2}{\beta^4} k_3 + \frac{B_{13}}{\beta} g_2 k_4 + 3\frac{B_{23}}{\beta^3} g_2 k_5 \quad = \quad 0.000306213 \qquad \text{B109}$$

$$L_{31} = (B_{11} + 0.5B_{12}) g_2 k_1 + (0.5B_{12} + B_{33}) \frac{g_2}{\beta^2} k_2 + 3\frac{B_{13}}{\beta} g_2 k_4 + \frac{B_{23}}{\beta^3} g_2 k_5 \quad = \quad 0.025604273 \qquad \text{B110}$$

$$L_{32} = (0.5\mathrm{B}_{12} + \mathrm{B}_{33})\frac{g_2}{\beta^2}k_2 + (0.5\mathrm{B}_{12} + \mathrm{B}_{22})\frac{g_2}{\beta^4}k_3 + \frac{B_{13}}{\beta}g_2k_4 + 3\frac{B_{23}}{\beta^3}g_2k_5 \quad = \; 0.000306213$$ B111

$$\mathrm{P}_2 = \frac{(L_{12}.L_{23} - L_{13}.L_{22})}{({L_{12}}^2 - L_{11}L_{22})} \quad = \quad 0.238235596$$ B112

$$\mathrm{P}_3 = \frac{(L_{12}.L_{13} - L_{11}L_{23})}{({L_{12}}^2 - L_{11}L_{22})} \quad = \quad 0.018369255$$ B113

$$k_{T1} = [\mathrm{B}_{11} - \mathrm{B}_{11}g_2\mathrm{P}_2 - 0.5\mathrm{B}_{12}g_2\mathrm{P}_2]k_1 \quad = \; 0.025665352$$ B114

$$k_{T2} = \frac{1}{2\beta^2}(2\mathrm{B}_{33} + \mathrm{B}_{12})[4 - g_2\mathrm{P}_2 - g_2\mathrm{P}_3]k_2 \; = \; 0.000381671$$ B115

$$k_{T3} = \frac{1}{\beta^4}[\mathrm{B}_{22} - \mathrm{B}_{22}g_2\mathrm{P}_3 - 0.5\mathrm{B}_{12}g_2\mathrm{P}_3]k_3 \quad = \; 0.000246686$$ B116

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2\mathrm{P}_2 - g_2\mathrm{P}_3]k_4 \quad = \quad 0$$ B117

$$k_{T5} = \frac{B_{23}}{\beta^3}.[4 - g_2\mathrm{P}_2 - 3g_2\mathrm{P}_3]k_5 \quad = \quad 0$$ B118

$$k_T = [\mathrm{B}_{11} - \mathrm{B}_{11}g_2\mathrm{P}_2 - 0.5\mathrm{B}_{12}g_2\mathrm{P}_2]k_1 + \frac{1}{2\beta^2}(2\mathrm{B}_{33} + \mathrm{B}_{12})[4 - g_2\mathrm{P}_2 - g_2\mathrm{P}_3]k_2 + \frac{1}{\beta^4}[\mathrm{B}_{22} - \mathrm{B}_{22}g_2\mathrm{P}_3 - 0.5\mathrm{B}_{12}g_2\mathrm{P}_3]k_3 + \frac{B_{13}}{\beta}[4 - 3g_2\mathrm{P}_2 - g_2\mathrm{P}_3]k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2\mathrm{P}_2 - 3g_2\mathrm{P}_3]k_5 = k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = 0.026293708$$ B119

$$\mathrm{A}_1 = \left(\frac{k_8}{k_T}\right)\frac{\mathrm{q}a^4}{\mathrm{D}_0} \quad = \quad 0.04225768.\frac{\mathrm{q}a^4}{\mathrm{D}_0}$$ B120

$$\phi_x = \left(\frac{\mathrm{k}_8}{\mathrm{k}_\mathrm{T}}\right)\mathrm{P}_2.\frac{\partial \mathrm{h}}{\partial \mathrm{R}}.\frac{\mathrm{qa}^3}{\mathrm{D}_0} \quad = \quad 0.000120807.\frac{\mathrm{q}a^3}{\mathrm{D}_0}$$ B121

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{\mathrm{P}_3}{\beta}.\frac{\partial \mathrm{h}}{\partial Q}\;\frac{\mathrm{q}a^3}{\mathrm{D}_0} \quad = \quad 6.20994\mathrm{E}-06.\frac{\mathrm{q}a^3}{\mathrm{D}_0}$$ B122

$$\mathrm{w} = \left(\frac{k_8}{k_T}\right)\mathrm{h}.\frac{12[1 - \mu_{xy}\mu_{yx}]\mathrm{q}a^4}{\mathrm{E}_0\mathrm{t}^3} \quad = \; 0.00198.\frac{\mathrm{q}a^4}{\mathrm{E}_0\mathrm{t}^3}$$ B123

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{\mathrm{a}}{\mathrm{t}}\right)^2\left[\mathrm{P}_2 - \frac{4}{3}\mathrm{P}_2 S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial \mathrm{h}}{\partial R}.\frac{\mathrm{qa}}{\mathrm{E}_0} \quad = \; -2.29763.\frac{\mathrm{q}a^3}{\mathrm{E}_0\mathrm{t}^2}$$ B124

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{\mathrm{a}}{\mathrm{t}}\right)^2\left[\mathrm{P}_3 - \frac{4}{3}\mathrm{P}_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial \mathrm{h}}{\partial Q}.\frac{\mathrm{qa}}{\mathrm{E}_0} \quad = \; -1.79867.\frac{\mathrm{q}a^3}{\mathrm{E}_0\mathrm{t}^2}$$ B125

$$\sigma_\mathrm{R} = 12\mathrm{qS}.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(\mathrm{B}_{11}.\left[\mathrm{P}_2 - \frac{4}{3}\mathrm{P}_2S^2 - 1\right].\frac{\partial^2\mathrm{h}}{\partial R^2} + \frac{\mathrm{B}_{12}}{\beta^2}.\left[\mathrm{P}_3 - \frac{4}{3}\mathrm{P}_3S^2 - 1\right].\frac{\partial^2\mathrm{h}}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[\mathrm{P}_2 + \mathrm{P}_3 - \frac{4}{3}\mathrm{P}_2S^2 - \frac{4}{3}\mathrm{P}_3S^2 - 2\right].\frac{\partial^2\mathrm{h}}{\partial \mathrm{R}\partial Q}\right) \; = \; -0.01098.\frac{\mathrm{q}a^2}{\mathrm{E}_0\mathrm{t}^2}$$ B126

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00034.\frac{qa^2}{E_0t^2} \quad \text{B127}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.00853.\frac{qa^2}{E_0t^2} \quad \text{B128}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.65073.\frac{qa}{E_0t} \quad \text{B129}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.01338.\frac{qa}{E_0t} \quad \text{B130}$$

For square plate, $\beta = 1.5$, $a/t = 40$, $\theta = \mathbf{0^o}$

$$L_{11} = g_3B_{11}k_1+\frac{B_{33}}{\beta^2}g_3k_2+2\frac{B_{13}}{\beta}g_3k_4+B_{44}.\left(\frac{a}{t}\right)^2.g_4.k_6 = 0.175024117 \quad \text{B131}$$

$$L_{12} = (B_{12}+B_{33})\frac{g_3}{\beta^2}k_2+\frac{B_{13}}{\beta}g_3k_4+\frac{B_{23}}{\beta^3}g_3k_5 = 7.81907E-05 \quad \text{B132}$$

$$L_{13} = (B_{11}+0.5B_{12})g_2k_1+(0.5B_{12}+B_{33})\frac{g_2}{\beta^2}k_2+3\frac{B_{13}}{\beta}g_2k_4+\frac{B_{23}}{\beta^3}g_2k_5 = 0.025604273 \quad \text{B133}$$

$$L_{21} = (B_{12}+B_{33})\frac{g_3}{\beta^2}.k_2+\frac{B_{13}}{\beta}g_3k_4+\frac{B_{23}}{\beta^3}g_3k_5 = 7.81907E-05 \quad \text{B134}$$

$$L_{22} = \frac{B_{22}}{\beta^4}g_3k_3+2\frac{B_{23}}{\beta^3}g_3k_5+\frac{B_{33}}{\beta^2}g_3k_2+\frac{B_{55}}{\beta^2}.\left(\frac{a}{t}\right)^2.g_4k_7 = 0.027665674 \quad \text{B135}$$

$$L_{23} = (0.5B_{12}+B_{33})\frac{g_2}{\beta^2}k_2+(0.5B_{12}+B_{22})\frac{g_2}{\beta^4}k_3+\frac{B_{13}}{\beta}g_2k_4+3\frac{B_{23}}{\beta^3}g_2k_5 = 0.000306213 \quad \text{B136}$$

$$L_{31} = (B_{11}+0.5B_{12})g_2k_1+(0.5B_{12}+B_{33})\frac{g_2}{\beta^2}k_2+3\frac{B_{13}}{\beta}g_2k_4+\frac{B_{23}}{\beta^3}g_2k_5 = 0.025604273 \quad \text{B137}$$

$$L_{32} = (0.5B_{12}+B_{33})\frac{g_2}{\beta^2}k_2+(0.5B_{12}+B_{22})\frac{g_2}{\beta^4}k_3+\frac{B_{13}}{\beta}g_2k_4+3\frac{B_{23}}{\beta^3}g_2k_5 = 0.000306213 \quad \text{B138}$$

$$P_2 = \frac{(L_{12}.L_{23}-L_{13}.L_{22})}{({L_{12}}^2-L_{11}L_{22})} = 0.146285212 \quad \text{B139}$$

$$P_3 = \frac{(L_{12}.L_{13}-L_{11}L_{23})}{({L_{12}}^2-L_{11}L_{22})} = 0.0106549 \quad \text{B140}$$

$$k_{T1} = [B_{11}-B_{11}g_2P_2-0.5B_{12}g_2P_2]k_1 = 0.028012276 \quad \text{B141}$$

$$k_{T2} = \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 = 0.00038969 \qquad B142$$

$$k_{T3} = \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 = 0.000248428 \qquad B143$$

$$k_{T4} = \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 = 0 \qquad B144$$

$$k_{T5} = \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 = 0 \qquad B145$$

$$k_T = [B_{11} - B_{11}g_2P_2 - 0.5B_{12}g_2P_2]k_1 + \frac{1}{2\beta^2}(2B_{33} + B_{12})[4 - g_2P_2 - g_2P_3]k_2 + \frac{1}{\beta^4}[B_{22} - B_{22}g_2P_3 - 0.5B_{12}g_2P_3]k_3 + \frac{B_{13}}{\beta}[4 - 3g_2P_2 - g_2P_3]k_4 + \frac{B_{23}}{\beta^3}.[4 - g_2P_2 - 3g_2P_3]k_5 = k_{T1} + k_{T2} + k_{T3} + k_{T4} + k_{T5} = 0.028650393 \qquad B146$$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.038781705.\frac{qa^4}{D_0} \qquad B147$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 6.80783E-05.\frac{qa^3}{D_0} \qquad B148$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 3.30572E-06.\frac{qa^3}{D_0} \qquad B149$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00181.\frac{qa^4}{E_0t^3} \qquad B150$$

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -4.02187.\frac{qa^3}{E_0t^2} \qquad B151$$

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -2.94989.\frac{qa^3}{E_0t^2} \qquad B152$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.01080.\frac{qa^2}{E_0t^2} \qquad B153$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00032.\frac{qa^2}{E_0t^2} \qquad B154$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.00811.\frac{qa^2}{E_0t^2} \qquad B155$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.65192.\frac{qa}{E_0t} \qquad B156$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.01266.\frac{qa}{E_0 t} \quad B157$$

For square plate, $\beta = 1.5$, $a/t = 50$, $\theta = \mathbf{0^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.03716865.\frac{qa^4}{D_0} \quad B158$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 4.36071E-05.\frac{qa^3}{D_0} \quad B159$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 2.05951E-06.\frac{qa^3}{D_0} \quad B160$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00181.\frac{qa^4}{E_0t^3} \quad B161$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -4.02187.\frac{qa^3}{E_0t^2} \quad B162$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -2.94989.\frac{qa^3}{E_0t^2} \quad B163$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = -0.01080.\frac{qa^2}{E_0t^2} \quad B164$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = -0.00032.\frac{qa^2}{E_0t^2} \quad B165$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.00811.\frac{qa^2}{E_0t^2} \quad B166$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.65192.\frac{qa}{E_0t} \quad B167$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.01266.\frac{qa}{E_0 t} \quad B168$$

For square plate, $\beta = 1.5$, $a/t = 60$, $\theta = \mathbf{0^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.036291308.\frac{qa^4}{D_0} \quad B169$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2 . \frac{\partial h}{\partial R} . \frac{qa^3}{D_0} \quad = \quad 3.02967E-05. \frac{qa^3}{D_0} \qquad B170$$

$$\phi_y = \left(\frac{k_8}{k_T}\right) \frac{P_3}{\beta} . \frac{\partial h}{\partial Q} \ \frac{qa^3}{D_0} \quad = \quad 1.40891E-06. \frac{qa^3}{D_0} \qquad B171$$

$$w = \left(\frac{k_8}{k_T}\right) h . \frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = \quad 0.00170. \frac{qa^4}{E_0 t^3} \qquad B172$$

$$u = 12[1-\mu_{xy}\mu_{yx}] \left(\frac{a}{t}\right)^2 \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . S. \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} . \frac{qa}{E_0} \quad = \quad -8.94801. \frac{qa^3}{E_0 t^2} \qquad B173$$

$$v = 12[1-\mu_{xy}\mu_{yx}] \left(\frac{a}{t}\right)^2 \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{S}{\beta} . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial Q} . \frac{qa}{E_0} \quad = \quad -6.23522. \frac{qa^3}{E_0 t^2} \qquad B174$$

$$\sigma_R = 12qS. \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \left(B_{11} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\right) \quad = \quad -0.01068. \frac{qa^2}{E_0 t^2} \qquad B175$$

$$\sigma_Q = 12qS. \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \left(B_{21} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\right) \quad = \quad -0.00030. \frac{qa^2}{E_0 t^2} \qquad B176$$

$$\tau_{RQ} = 12qS. \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \left(B_{31} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\right) \quad = \quad 0.00781. \frac{qa^2}{E_0 t^2} \qquad B177$$

$$\tau_{RS} = 12q \left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2) . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} \quad = \quad 0.65277. \frac{qa}{E_0 t} \qquad B178$$

$$\tau_{QS} = 12q \left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta} (P_3 - 4P_3 S^2) . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial Q} \quad = \quad 0.01214. \frac{qa}{E_0 t} \qquad B179$$

For square plate, $\beta = 1.5$, a/t = 70, $\theta = \mathbf{0^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right) \frac{qa^4}{D_0} \quad = \quad 0.035761918. \frac{qa^4}{D_0} \qquad B180$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2 . \frac{\partial h}{\partial R} . \frac{qa^3}{D_0} \quad = \quad 2.2265E-05. \frac{qa^3}{D_0} \qquad B181$$

$$\phi_y = \left(\frac{k_8}{k_T}\right) \frac{P_3}{\beta} . \frac{\partial h}{\partial Q} \ \frac{qa^3}{D_0} \quad = \quad 1.02565E-06. \frac{qa^3}{D_0} \qquad B182$$

$$w = \left(\frac{k_8}{k_T}\right) h . \frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = \quad 0.00167. \frac{qa^4}{E_0 t^3} \qquad B183$$

$$u = 12[1-\mu_{xy}\mu_{yx}] \left(\frac{a}{t}\right)^2 \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . S. \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} . \frac{qa}{E_0} \quad = \quad -12.14996. \frac{qa^3}{E_0 t^2} \qquad B184$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -8.37012.\frac{qa^3}{E_0t^2} \quad \text{B185}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.01065.\frac{qa^2}{E_0t^2} \quad \text{B186}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00030.\frac{qa^2}{E_0t^2} \quad \text{B187}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.00774.\frac{qa^2}{E_0t^2} \quad \text{B188}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.65295.\frac{qa}{E_0t} \quad \text{B189}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.01203.\frac{qa}{E_0t} \quad \text{B190}$$

For square plate, $\beta = 1.5$, $a/t = 80$, $\theta = \mathbf{0^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.035418171.\frac{qa^4}{D_0} \quad \text{B191}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.70497E-05.\frac{qa^3}{D_0} \quad \text{B192}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 7.80549E-07.\frac{qa^3}{D_0} \quad \text{B193}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00166.\frac{qa^4}{E_0t^3} \quad \text{B194}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -15.84451.\frac{qa^3}{E_0t^2} \quad \text{B195}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -10.83333.\frac{qa^3}{E_0t^2} \quad \text{B196}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.01064.\frac{qa^2}{E_0t^2} \quad \text{B197}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00030.\frac{qa^2}{E_0t^2} \quad \text{B198}$$

$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.00770.\frac{qa^2}{E_0t^2}$ B199

$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.65307.\frac{qa}{E_0t}$ B200

$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.01196.\frac{qa}{E_0t}$ B201

For square plate, $\beta = 1.5$, a/t = 90, $\theta = \mathbf{0^o}$

$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.035182428.\frac{qa^4}{D_0}$ B202

$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.3473E-05.\frac{qa^3}{D_0}$ B203

$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 6.14173E-07.\frac{qa^3}{D_0}$ B204

$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00165.\frac{qa^4}{E_0t^3}$ B205

$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -20.03166.\frac{qa^3}{E_0t^2}$ B206

$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -13.62488.\frac{qa^3}{E_0t^2}$ B207

$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.01063.\frac{qa^2}{E_0t^2}$ B208

$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00030.\frac{qa^2}{E_0t^2}$ B209

$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.00767.\frac{qa^2}{E_0t^2}$ B210

$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.65315.\frac{qa}{E_0t}$ B211

$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.01191.\frac{qa}{E_0t}$ B212

For square plate, $\beta = 1.5$, a/t = 100, $\theta = \mathbf{0^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.035013769.\frac{qa^4}{D_0} \qquad \text{B213}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 1.09141E-05.\frac{qa^3}{D_0} \qquad \text{B214}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 4.95997E-07.\frac{qa^3}{D_0} \qquad \text{B215}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00164.\frac{qa^4}{E_0t^3} \qquad \text{B216}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -24.71141.\frac{qa^3}{E_0t^2} \qquad \text{B217}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -16.74480.\frac{qa^3}{E_0t^2} \qquad \text{B218}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial}\right) = -0.01062.\frac{qa^2}{E_0t^2} \qquad \text{B219}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00030.\frac{qa^2}{E_0t^2} \qquad \text{B220}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.00765.\frac{qa^2}{E_0t^2} \qquad \text{B221}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.65321.\frac{qa}{E_0t} \qquad \text{B222}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.01187.\frac{qa}{E_0t} \qquad \text{B223}$$

For square plate, $\beta = 1.5$, $a/t = 5$, $\theta = \mathbf{15^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.364450976.\frac{qa^4}{D_0} \qquad \text{B224}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 0.00494673.\frac{qa^3}{D_0} \qquad \text{B225}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 0.001174963.\frac{qa^3}{D_0} \qquad \text{B226}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.011722219.\frac{qa^4}{E_0t^3} \qquad \text{B227}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad 0.01704.\frac{qa^3}{E_0t^2} \qquad \text{B228}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.31905.\frac{qa^3}{E_0 t^2} \quad \text{B229}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.31784.\frac{qa^2}{E_0 t^2} \quad \text{B230}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.02747.\frac{qa^2}{E_0 t^2} \quad \text{B231}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.16179.\frac{qa^2}{E_0 t^2} \quad \text{B232}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.74015.\frac{qa}{E_0 t} \quad \text{B233}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.07032.\frac{qa}{E_0 t} \quad \text{B234}$$

For square plate, $\beta = 1.5$, $a/t = 10$, $\theta = \mathbf{15^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.110712716.\frac{qa^4}{D_0} \quad \text{B235}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.001116202.\frac{qa^3}{D_0} \quad \text{B236}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 0.000185965.\frac{qa^3}{D_0} \quad \text{B237}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} = 0.00518.\frac{qa^4}{E_0 t^3} \quad \text{B238}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -0.34977.\frac{qa^3}{E_0 t^2} \quad \text{B239}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.45589.\frac{qa^3}{E_0 t^2} \quad \text{B240}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.13168.\frac{qa^2}{E_0 t^2} \quad \text{B241}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.01129.\frac{qa^2}{E_0 t^2} \quad \text{B242}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.06619.\frac{qa^2}{E_0t^2} \quad \text{B243}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.66805.\frac{qa}{E_0t} \quad \text{B244}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.04452.\frac{qa}{E_0t} \quad \text{B245}$$

For square plate, $\beta = 1.5$, $a/t = 20$, $\theta = \mathbf{15^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.055077072.\frac{qa^4}{D_0} \quad \text{B246}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.000272996.\ \frac{qa^3}{D_0} \quad \text{B247}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 3.68531E-05.\frac{qa^3}{D_0} \quad \text{B248}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00258.\frac{qa^4}{E_0t^3} \quad \text{B249}$$

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -1.14655.\frac{qa^3}{E_0t^2} \quad \text{B250}$$

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.99602.\frac{qa^3}{E_0t^2} \quad \text{B251}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.08639.\frac{qa^2}{E_0t^2} \quad \text{B252}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00734.\frac{qa^2}{E_0t^2} \quad \text{B253}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.04286.\frac{qa^2}{E_0t^2} \quad \text{B254}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.65355.\frac{qa}{E_0t} \quad \text{B255}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.03529.\frac{qa}{E_0t} \quad \text{B256}$$

For square plate, $\beta = 1.5$, $a/t = 30$, $\theta = \mathbf{15^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.045057063.\frac{qa^4}{D_0} \qquad B257$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 0.000120867.\ \frac{qa^3}{D_0} \qquad B258$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 1.54736E-05.\frac{qa^3}{D_0} \qquad B259$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00211.\frac{qa^4}{E_0t^3} \qquad B260$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -2.47837.\frac{qa^3}{E_0t^2} \qquad B261$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -1.88603.\frac{qa^3}{E_0t^2} \qquad B262$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.07787.\frac{qa^2}{E_0t^2} \qquad B263$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00660.\frac{qa^2}{E_0t^2} \qquad B264$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.03846.\frac{qa^2}{E_0t^2} \qquad B265$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.65105.\frac{qa}{E_0t} \qquad B266$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.03334.\frac{qa}{E_0t} \qquad B267$$

For square plate, $\beta = 1.5$, a/t = 40, $\theta = 15^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.04156981.\frac{qa^4}{D_0} \qquad B268$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 6.78975E-05.\ \frac{qa^3}{D_0} \qquad B269$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 8.51996E-06.\frac{qa^3}{D_0} \qquad B270$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00194.\frac{qa^4}{E_0t^3} \qquad B271$$

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -4.34341.\frac{qa^3}{E_0 t^2} \quad \text{B272}$$

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -3.13019.\frac{qa^3}{E_0 t^2} \quad \text{B273}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.07487.\frac{qa^2}{E_0 t^2} \quad \text{B274}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00634.\frac{qa^2}{E_0 t^2} \quad \text{B275}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.03691.\frac{qa^2}{E_0 t^2} \quad \text{B276}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.65019.\frac{qa}{E_0 t} \quad \text{B277}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.03263.\frac{qa}{E_0 t} \quad \text{B278}$$

For square plate, $\beta = 1.5$, $a/t = 50$, $\theta = 15^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.03995913.\frac{qa^4}{D_0} \quad \text{B279}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 4.34279E-05.\frac{qa^3}{D_0} \quad \text{B280}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 5.3976E-06.\frac{qa^3}{D_0} \quad \text{B281}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} = 0.00187.\frac{qa^4}{E_0 t^3} \quad \text{B282}$$

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -6.74147.\frac{qa^3}{E_0 t^2} \quad \text{B283}$$

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -4.72927.\frac{qa^3}{E_0 t^2} \quad \text{B284}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.07348.\frac{qa^2}{E_0 t^2} \quad \text{B285}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{21}.\Big[P_2 - \frac{4}{3}P_2S^2 - 1\Big].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\Big[P_3 - \frac{4}{3}P_3S^2 - 1\Big].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\Big[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\Big].\frac{\partial^2 h}{\partial R\partial Q}\Big) = -0.00621.\frac{qa^2}{E_0t^2} \quad B286$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{31}.\Big[P_2 - \frac{4}{3}P_2S^2 - 1\Big].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\Big[P_3 - \frac{4}{3}P_3S^2 - 1\Big].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\Big[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\Big].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.03619.\frac{qa^2}{E_0t^2} \quad B287$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.64979.\frac{qa}{E_0t} \quad B288$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.03230.\frac{qa}{E_0t} \quad B289$$

For square plate, $\beta = 1$, a/t = 60, $\theta = 15^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.039085094.\frac{qa^4}{D_0} \quad B290$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 3.01483E-05.\frac{qa^3}{D_0} \quad B291$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 3.7274E-06.\frac{qa^3}{D_0} \quad B292$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00183.\frac{qa^4}{E_0t^3} \quad B293$$

$$u = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\Big[P_2 - \frac{4}{3}P_2S^2 - 1\Big].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -9.67248.\frac{qa^3}{E_0t^2} \quad B294$$

$$v = 12[1 - \mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\Big[P_3 - \frac{4}{3}P_3S^2 - 1\Big].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -6.68348.\frac{qa^3}{E_0t^2} \quad B295$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{11}.\Big[P_2 - \frac{4}{3}P_2S^2 - 1\Big].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\Big[P_3 - \frac{4}{3}P_3S^2 - 1\Big].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\Big[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\Big].\frac{\partial^2 h}{\partial R\partial Q}\Big) = -0.07273.\frac{qa^2}{E_0t^2} \quad B296$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{21}.\Big[P_2 - \frac{4}{3}P_2S^2 - 1\Big].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\Big[P_3 - \frac{4}{3}P_3S^2 - 1\Big].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\Big[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\Big].\frac{\partial^2 h}{\partial R\partial Q}\Big) = -0.00615.\frac{qa^2}{E_0t^2} \quad B297$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{31}.\Big[P_2 - \frac{4}{3}P_2S^2 - 1\Big].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\Big[P_3 - \frac{4}{3}P_3S^2 - 1\Big].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\Big[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\Big].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.03580.\frac{qa^2}{E_0t^2} \quad B298$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.64958.\frac{qa}{E_0t} \quad B299$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.03212\,.\frac{qa}{E_0 t} \quad \text{B300}$$

For square plate, β = 1, a/t = 70, θ = 15°

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.038558385.\frac{qa^4}{D_0} \quad \text{B300}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 2.21454E-05\,.\frac{qa^3}{D_0} \quad \text{B301}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\,\frac{qa^3}{D_0} = 2.72919E-06.\frac{qa^3}{D_0} \quad \text{B302}$$

$$w = \left(\frac{k_8}{k_T}\right)h\,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00180.\frac{qa^4}{E_0t^3} \quad \text{B303}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -13.13643.\frac{qa^3}{E_0t^2} \quad \text{B304}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -8.99290.\frac{qa^3}{E_0t^2} \quad \text{B305}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = -0.07227.\frac{qa^2}{E_0t^2} \quad \text{B306}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = -0.00611.\frac{qa^2}{E_0t^2} \quad \text{B307}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.03557.\frac{qa^2}{E_0t^2} \quad \text{B308}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.64945.\frac{qa}{E_0t} \quad \text{B309}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.03202.\frac{qa}{E_0t} \quad \text{B310}$$

For square plate, β = 1.5, a/t = 80, θ = 15°

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.038216653.\frac{qa^4}{D_0} \quad \text{B311}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.69529E-05.\frac{qa^3}{D_0} \quad \text{B312}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\,\frac{qa^3}{D_0} = 2.0849E-06.\frac{qa^3}{D_0} \quad \text{B313}$$

$$w = \left(\frac{k_8}{k_T}\right) h\,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00179.\frac{qa^4}{E_0t^3} \qquad B314$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -17.13330.\frac{qa^3}{E_0t^2} \qquad B315$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -11.65757.\frac{qa^3}{E_0t^2} \qquad B316$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.07198.\frac{qa^2}{E_0t^2} \qquad B317$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00608.\frac{qa^2}{E_0t^2} \qquad B318$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.03542.\frac{qa^2}{E_0t^2} \qquad B319$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.64936.\frac{qa}{E_0t} \qquad B320$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.03194.\frac{qa}{E_0t} \qquad B321$$

For square plate, $\beta = 1.5$, a/t = 90, $\theta = \mathbf{15^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.037982418.\frac{qa^4}{D_0} \qquad B322$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 1.33937E-05.\ \frac{qa^3}{D_0} \qquad B323$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 1.64481E-06.\frac{qa^3}{D_0} \qquad B324$$

$$w = \left(\frac{k_8}{k_T}\right) h\,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00178.\frac{qa^4}{E_0t^3} \qquad B325$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -21.66310.\frac{qa^3}{E_0t^2} \qquad B326$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -14.67749.\frac{qa^3}{E_0t^2} \qquad B327$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.07177.\frac{qa^2}{E_0t^2} \qquad B328$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00607.\frac{qa^2}{E_0t^2} \quad B329$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.03531.\frac{qa^2}{E_0t^2} \quad B330$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.64931.\frac{qa}{E_0t} \quad B331$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.03190.\frac{qa}{E_0t} \quad B332$$

For square plate, $\beta = 1$, a/t = 100, $\theta = 15^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.0378149.\frac{qa^4}{D_0} \quad B333$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.08482E-05.\frac{qa^3}{D_0} \quad B334$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 1.33084E-06.\frac{qa^3}{D_0} \quad B335$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00177.\frac{qa^4}{E_0t^3} \quad B336$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -26.72582.\frac{qa^3}{E_0t^2} \quad B337$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -18.05267.\frac{qa^3}{E_0t^2} \quad B338$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.07163.\frac{qa^2}{E_0t^2} \quad B339$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00605.\frac{qa^2}{E_0t^2} \quad B340$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.03524.\frac{qa^2}{E_0t^2} \quad B341$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.64926.\frac{qa}{E_0t} \quad B342$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.03186.\frac{qa}{E_0 t} \quad B343$$

For square plate, $\beta = 1.5$, a/t = 5, $\theta = \mathbf{30^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.764006809.\frac{qa^4}{D_0} \quad B344$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.010796817.\frac{qa^3}{D_0} \quad B345$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 0.003340992.\frac{qa^3}{D_0} \quad B346$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.03572.\frac{qa^4}{E_0t^3} \quad B347$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -0.29479.\frac{qa^3}{E_0t^2} \quad B348$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.58125.\frac{qa^3}{E_0t^2} \quad B349$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.78345.\frac{qa^2}{E_0t^2} \quad B350$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.27034.\frac{qa^2}{E_0t^2} \quad B351$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.72773.\frac{qa^2}{E_0t^2} \quad B352$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 1.61547.\frac{qa}{E_0t} \quad B353$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.19996.\frac{qa}{E_0t} \quad B354$$

For square plate, $\beta = 1$, a/t = 10, $\theta = \mathbf{30^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.129807172.\frac{qa^4}{D_0} \quad B355$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.001243951.\frac{qa^3}{D_0} \quad B356$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 0.000440318.\frac{qa^3}{D_0} \quad B357$$

$$w = \left(\frac{k_8}{k_T}\right) h \,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = \quad 0.00607.\frac{qa^4}{E_0 t^3} \qquad B358$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\; P_2\, S^2 - 1\right] .S.\left(\frac{k_8}{k_T}\right) .\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -0.43594.\frac{qa^3}{E_0 t^2} \qquad B359$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3} P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -0.44583.\frac{qa^3}{E_0 t^2} \qquad B360$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.18882.\frac{qa^2}{E_0 t^2} \qquad B361$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.06493.\frac{qa^2}{E_0 t^2} \qquad B362$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.17403.\frac{qa^2}{E_0 t^2} \qquad B363$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.74450.\frac{qa}{E_0 t} \qquad B364$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.10541.\frac{qa}{E_0 t} \qquad B365$$

For square plate, $\beta = 1$, $a/t = 20$, $\theta = \mathbf{30^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.064954676.\frac{qa^4}{D_0} \qquad B366$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 0.000273288.\frac{qa^3}{D_0} \qquad B367$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\;\frac{qa^3}{D_0} \quad = \quad 0.000104688.\frac{qa^3}{D_0} \qquad B368$$

$$w = \left(\frac{k_8}{k_T}\right) h \,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = \quad 0.00304.\frac{qa^4}{E_0 t^3} \qquad B369$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\; P_2\, S^2 - 1\right] .S.\left(\frac{k_8}{k_T}\right) .\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -1.42985.\frac{qa^3}{E_0 t^2} \qquad B370$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3} P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -1.07693.\frac{qa^3}{E_0 t^2} \qquad B371$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.13135.\frac{qa^2}{E_0 t^2} \qquad B372$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.04509.\frac{qa^2}{E_0t^2} \quad B373$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.12057.\frac{qa^2}{E_0t^2} \quad B374$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.65425.\frac{qa}{E_0t} \quad B375$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.10025.\frac{qa}{E_0t} \quad B376$$

For square plate, $\beta = 1$, a/t = 30, $\theta = 30^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.054580969.\frac{qa^4}{D_0} \quad B377$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.000118755.\frac{qa^3}{D_0} \quad B378$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 4.63918E-05.\frac{qa^3}{D_0} \quad B379$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00255.\frac{qa^4}{E_0t^3} \quad B380$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -3.10156.\frac{qa^3}{E_0t^2} \quad B381$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -2.18541.\frac{qa^3}{E_0t^2} \quad B382$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.12255.\frac{qa^2}{E_0t^2} \quad B383$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.04206.\frac{qa^2}{E_0t^2} \quad B384$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.11240.\frac{qa^2}{E_0t^2} \quad B385$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.63967.\frac{qa}{E_0t} \quad B386$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.09996\,.\frac{qa}{E_0 t} \qquad \text{B387}$$

For square plate, $\beta = 1$, a/t = 40, $\theta = \mathbf{30^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.051053224.\frac{qa^4}{D_0} \qquad \text{B388}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 6.62806E-05.\ \frac{qa^3}{D_0} \qquad \text{B389}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 2.60839E-05.\frac{qa^3}{D_0} \qquad \text{B390}$$

$$w = \left(\frac{k_8}{k_T}\right)h\,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00239.\frac{qa^4}{E_0t^3} \qquad \text{B391}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\,P_2\,S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -5.44349.\frac{qa^3}{E_0t^2} \qquad \text{B392}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -3.74457.\frac{qa^3}{E_0t^2} \qquad \text{B393}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -3.74457.\frac{qa^2}{E_0t^2} \qquad \text{B384}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.04104.\frac{qa^2}{E_0t^2} \qquad \text{B395}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.10966.\frac{qa^2}{E_0t^2} \qquad \text{B386}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.63470.\frac{qa}{E_0 t} \qquad \text{B397}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.09991.\frac{qa}{E_0 t} \qquad \text{B398}$$

For square plate, $\beta = 1$, a/t = 50, $\theta = \mathbf{30^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.04943787.\frac{qa^4}{D_0} \qquad \text{B399}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 4.22672E-05.\ \frac{qa^3}{D_0} \qquad \text{B400}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 1.66921E-05.\frac{qa^3}{D_0} \qquad \text{B401}$$

$$w = \left(\frac{k_8}{k_T}\right) h . \frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = \quad 0.00231. \frac{qa^4}{E_0 t^3} \qquad B402$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right] .S. \left(\frac{k_8}{k_T}\right) .\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -8.45495. \frac{qa^3}{E_0 t^2} \qquad B403$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -5.75121. \frac{qa^3}{E_0 t^2} \qquad B404$$

$$\sigma_R = 12qS. \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right). \left(B_{11} . \left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2} . \left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta} . \left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.11826. \frac{qa^2}{E_0 t^2} \qquad B405$$

$$\sigma_Q = 12qS. \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right). \left(B_{21} . \left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2} . \left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta} . \left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.04057. \frac{qa^2}{E_0 t^2} \qquad B406$$

$$\tau_{RQ} = 12qS. \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right). \left(B_{31} . \left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2} . \left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta} . \left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.10841. \frac{qa^2}{E_0 t^2} \qquad B407$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.63242. \frac{qa}{E_0 t} \qquad B408$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = 0.09990. \frac{qa}{E_0 t} \qquad B409$$

For square plate, $\beta = 1.5$, $a/t = 60$, $\theta = \mathbf{30^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.048564971. \frac{qa^4}{D_0} \qquad B410$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2 . \frac{\partial h}{\partial R} . \frac{qa^3}{D_0} \quad = \quad 2.9295E-05. \frac{qa^3}{D_0} \qquad B411$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 1.15915E-05. \frac{qa^3}{D_0} \qquad B412$$

$$w = \left(\frac{k_8}{k_T}\right) h . \frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = \quad 0.00227. \frac{qa^4}{E_0 t^3} \qquad B413$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right] .S. \left(\frac{k_8}{k_T}\right) .\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -12.13578. \frac{qa^3}{E_0 t^2} \qquad B414$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -8.20455. \frac{qa^3}{E_0 t^2} \qquad B415$$

$$\sigma_R = 12qS. \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right). \left(B_{11} . \left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2} . \left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta} . \left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.11753. \frac{qa^2}{E_0 t^2} \qquad B416$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.04032.\frac{qa^2}{E_0t^2} \quad B417$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.10774.\frac{qa^2}{E_0t^2} \quad B418$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.63119.\frac{qa}{E_0t} \quad B419$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.09990.\frac{qa}{E_0t} \quad B420$$

For square plate, $\beta = 1.5$, $a/t = 70$, $\theta = \mathbf{30^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.048040187.\frac{qa^4}{D_0} \quad B421$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 2.14976E-05.\ \frac{qa^3}{D_0} \quad B422$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 8.51617E-06.\frac{qa^3}{D_0} \quad B423$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00225.\frac{qa^4}{E_0t^3} \quad B424$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -16.48591.\frac{qa^3}{E_0t^2} \quad B425$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -11.10430.\frac{qa^3}{E_0t^2} \quad B426$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.11710.\frac{qa^2}{E_0t^2} \quad B427$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.04017.\frac{qa^2}{E_0t^2} \quad B428$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.10733.\frac{qa^2}{E_0t^2} \quad B429$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.63045.\frac{qa}{E_0t} \quad B430$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.09990\,.\frac{qa}{E_0 t} \quad \text{B431}$$

For square plate, $\beta = 1$, $a/t = 80$, $\theta = \mathbf{30^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.047700202.\frac{qa^4}{D_0} \quad \text{B432}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.64466E-05.\frac{qa^3}{D_0} \quad \text{B433}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 6.52021E-06.\frac{qa^3}{D_0} \quad \text{B434}$$

$$w = \left(\frac{k_8}{k_T}\right)h\,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} = 0.00223.\frac{qa^4}{E_0 t^3} \quad \text{B435}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -21.50532.\frac{qa^3}{E_0 t^2} \quad \text{B436}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -14.45037.\frac{qa^3}{E_0 t^2} \quad \text{B437}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.11682.\frac{qa^2}{E_0 t^2} \quad \text{B438}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.04008.\frac{qa^2}{E_0 t^2} \quad \text{B439}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.10707.\frac{qa^2}{E_0 t^2} \quad \text{B440}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.62997.\frac{qa}{E_0 t} \quad \text{B441}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.09990.\frac{qa}{E_0 t} \quad \text{B442}$$

For square plate, $\beta = 1$, $a/t = 90$, $\theta = \mathbf{30^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.047467391.\frac{qa^4}{D_0} \quad \text{B443}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.2988E-05.\frac{qa^3}{D_0} \quad \text{B444}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 5.15179E-06.\frac{qa^3}{D_0} \quad \text{B445}$$

$$w = \left(\frac{k_8}{k_T}\right) h \,.\frac{12[1-\mu_{xy}\mu_{yx}]q a^4}{E_0 t^3} \quad = \quad 0.00222.\frac{q a^4}{E_0 t^3} \qquad B446$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2 \left[P_2 - \frac{4}{3}\ P_2\, S^2 - 1\right] .S.\left(\frac{k_8}{k_T}\right) .\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -27.19402.\frac{q a^3}{E_0 t^2} \qquad B447$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2 \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -18.24268.\frac{q a^3}{E_0 t^2} \qquad B448$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right).\Big(B_{11}.\left[P_2 - \frac{4}{3} P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3} P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\Big) = \quad -0.11662.\frac{q a^2}{E_0 t^2} \qquad B449$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right).\Big(B_{21}.\left[P_2 - \frac{4}{3} P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3} P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\Big) = \quad -0.04001.\frac{q a^2}{E_0 t^2} \qquad B450$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right).\Big(B_{31}.\left[P_2 - \frac{4}{3} P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3} P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\Big) = 0.10689.\frac{q a^2}{E_0 t^2} \qquad B451$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = \quad 0.62964.\frac{qa}{E_0 t} \qquad B452$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = \quad 0.09990.\frac{qa}{E_0 t} \qquad B453$$

For square plate, $\beta = 1$, a/t = 100, $\theta = \mathbf{30^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{q a^4}{D_0} \quad = \quad 0.047301003.\frac{q a^4}{D_0} \qquad B454$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2.\frac{\partial h}{\partial R}.\frac{q a^3}{D_0} \quad = \quad 1.05164E-05.\ \frac{q a^3}{D_0} \qquad B455$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \ \frac{q a^3}{D_0} \quad = \quad 4.17296E-06.\frac{q a^3}{D_0} \qquad B456$$

$$w = \left(\frac{k_8}{k_T}\right) h \,.\frac{12[1-\mu_{xy}\mu_{yx}]q a^4}{E_0 t^3} \quad = \quad 0.001633033.\frac{q a^4}{E_0 t^3} \qquad B457$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2 \left[P_2 - \frac{4}{3}\ P_2\, S^2 - 1\right] .S.\left(\frac{k_8}{k_T}\right) .\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -33.55198.\frac{q a^3}{E_0 t^2} \qquad B458$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2 \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -22.48122.\frac{q a^3}{E_0 t^2} \qquad B459$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right).\Big(B_{11}.\left[P_2 - \frac{4}{3} P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3} P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\Big) = \quad -0.11649.\frac{q a^2}{E_0 t^2} \qquad B460$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.03996.\frac{qa^2}{E_0t^2} \quad B461$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.10677.\frac{qa^2}{E_0t^2} \quad B462$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.62940.\frac{qa}{E_0t} \quad B463$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.09990.\frac{qa}{E_0t} \quad B464$$

For square plate, β = 1.5, a/t = 5, θ = 45°

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 1.476615932.\frac{qa^4}{D_0} \quad B465$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.020958285.\frac{qa^3}{D_0} \quad B466$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 0.009010073.\frac{qa^3}{D_0} \quad B467$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.06904.\frac{qa^4}{E_0t^3} \quad B468$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -0.56067.\frac{qa^3}{E_0t^2} \quad B469$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.86875.\frac{qa^3}{E_0t^2} \quad B470$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.97001.\frac{qa^2}{E_0t^2} \quad B471$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.97014.\frac{qa^2}{E_0t^2} \quad B472$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 1.51050.\frac{qa^2}{E_0t^2} \quad B473$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 3.13588.\frac{qa}{E_0t} \quad B474$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.53925.\frac{qa}{E_0 t} \quad B475$$

For square plate, β = 1.5, a/t = 10, θ = 45°

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.157131666.\frac{qa^4}{D_0} \quad B476$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.001245109.\frac{qa^3}{D_0} \quad B477$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 0.000852434.\frac{qa^3}{D_0} \quad B478$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} = 0.00735.\frac{qa^4}{E_0 t^3} \quad B479$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -0.63172.\frac{qa^3}{E_0 t^2} \quad B480$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.41223.\frac{qa^3}{E_0 t^2} \quad B481$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.16457.\frac{qa^2}{E_0 t^2} \quad B482$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.16396.\frac{qa^2}{E_0 t^2} \quad B483$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.25473.\frac{qa^2}{E_0 t^2} \quad B484$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.74520.\frac{qa}{E_0 t} \quad B485$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.20407.\frac{qa}{E_0 t} \quad B486$$

For square plate, β = 1.5, a/t = 20, θ = 45°

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.085698374.\frac{qa^4}{D_0} \quad B487$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.000253504.\frac{qa^3}{D_0} \quad B488$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 0.000232051.\frac{qa^3}{D_0} \quad B489$$

$$w = \left(\frac{k_8}{k_T}\right) h . \frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = \quad 0.00401. \frac{qa^4}{E_0 t^3} \qquad B490$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2 \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . S. \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} . \frac{qa}{E_0} \quad = \quad -2.05735. \frac{qa^3}{E_0 t^2} \qquad B491$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2 \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{S}{\beta} . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial Q} . \frac{qa}{E_0} \quad = \quad -1.27094. \frac{qa^3}{E_0 t^2} \qquad B492$$

$$\sigma_R = 12qS. \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \left(B_{11} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\right) = -0.13056. \frac{qa^2}{E_0 t^2} \qquad B493$$

$$\sigma_Q = 12qS. \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \left(B_{21} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\right) = -0.13004. \frac{qa^2}{E_0 t^2} \qquad B494$$

$$\tau_{RQ} = 12qS. \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \left(B_{31} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\right) = 0.20201. \frac{qa^2}{E_0 t^2} \qquad B495$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2) . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} = 0.60689. \frac{qa}{E_0 t} \qquad B496$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2) . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial Q} \quad = 0.22221. \frac{qa}{E_0 t} \qquad B497$$

For square plate, $\beta = 1.5$, $a/t = 30$, $\theta = 45^o$

$$A_1 = \left(\frac{k_8}{k_T}\right) \frac{qa^4}{D_0} \quad = \quad 0.074417914. \frac{qa^4}{D_0} \qquad B498$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2 . \frac{\partial h}{\partial R} . \frac{qa^3}{D_0} \quad = \quad 0.000108364. \frac{qa^3}{D_0} \qquad B499$$

$$\phi_y = \left(\frac{k_8}{k_T}\right) \frac{P_3}{\beta} . \frac{\partial h}{\partial Q} \frac{qa^3}{D_0} \quad = \quad 0.000107014. \frac{qa^3}{D_0} \qquad B500$$

$$w = \left(\frac{k_8}{k_T}\right) h . \frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = \quad 0.00348. \frac{qa^4}{E_0 t^3} \qquad B501$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2 \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . S. \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial R} . \frac{qa}{E_0} \quad = \quad -4.42109. \frac{qa^3}{E_0 t^2} \qquad B502$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2 \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{S}{\beta} . \left(\frac{k_8}{k_T}\right) . \frac{\partial h}{\partial Q} . \frac{qa}{E_0} \quad = \quad -2.82253. \frac{qa^3}{E_0 t^2} \qquad B503$$

$$\sigma_R = 12qS. \left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right) . \left(B_{11} . \left[P_2 - \frac{4}{3} P_2 S^2 - 1\right] . \frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2} . \left[P_3 - \frac{4}{3} P_3 S^2 - 1\right] . \frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta} . \left[P_2 + P_3 - \frac{4}{3} P_2 S^2 - \frac{4}{3} P_3 S^2 - 2\right] . \frac{\partial^2 h}{\partial R \partial Q}\right) = -0.12664. \frac{qa^2}{E_0 t^2} \qquad B504$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.12616.\frac{qa^2}{E_0t^2} \quad \text{B505}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.19599.\frac{qa^2}{E_0t^2} \quad \text{B506}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.58370.\frac{qa}{E_0t} \quad \text{B507}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.23057.\frac{qa}{E_0t} \quad \text{B508}$$

For square plate, $\beta = 1.5$, $a/t = 40$, $\theta = \mathbf{45^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.070563186.\frac{qa^4}{D_0} \quad \text{B509}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 6.01106E-05.\frac{qa^3}{D_0} \quad \text{B510}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 6.11093E-05.\frac{qa^3}{D_0} \quad \text{B511}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00330.\frac{qa^4}{E_0t^3} \quad \text{B512}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -7.72481.\frac{qa^3}{E_0t^2} \quad \text{B513}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -5.01558.\frac{qa^3}{E_0t^2} \quad \text{B514}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.12547.\frac{qa^2}{E_0t^2} \quad \text{B515}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial}\right) = -0.12501.\frac{qa^2}{E_0t^2} \quad \text{B516}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.19421.\frac{qa^2}{E_0t^2} \quad \text{B517}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.57562.\frac{qa}{E_0t} \quad \text{B518}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = 0.23407.\frac{qa}{E_0 t} \qquad \text{B519}$$

For square plate, β = 1.5, a/t = 50, θ = $\mathbf{45^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.068793171.\frac{qa^4}{D_0} \qquad \text{B520}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 3.82207E-05.\ \frac{qa^3}{D_0} \qquad \text{B521}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 3.94E-05.\frac{qa^3}{D_0} \qquad \text{B522}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \ 0.00322.\frac{qa^4}{E_0t^3} \qquad \text{B523}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \ -11.97056.\frac{qa^3}{E_0t^2} \qquad \text{B524}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \ -7.84153.\frac{qa^3}{E_0t^2} \qquad \text{B525}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} +$$
$$\frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = \qquad -0.12497.\frac{qa^2}{E_0t^2} \qquad \text{B526}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} +$$
$$\frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = \qquad -0.12451.\frac{qa^2}{E_0t^2} \qquad \text{B527}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} +$$
$$\frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = \ 0.19344.\frac{qa^2}{E_0t^2} \qquad \text{B528}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = \ 0.57188.\frac{qa}{E_0 t} \qquad \text{B529}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = 0.23581.\frac{qa}{E_0 t} \qquad \text{B530}$$

For square plate, β = 1.5, a/t = 60, θ = $\mathbf{45^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.067835191.\frac{qa^4}{D_0} \qquad \text{B531}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 2.64477E-05.\ \frac{qa^3}{D_0} \qquad \text{B532}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 2.74743E-05.\frac{qa^3}{D_0} \qquad B533$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00317.\frac{qa^4}{E_0t^3} \qquad B534$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -17.15903.\frac{qa^3}{E_0t^2} \qquad B535$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -11.29798.\frac{qa^3}{E_0t^2} \qquad B536$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = -0.12471.\frac{qa^2}{E_0t^2} \qquad B537$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = -0.12425.\frac{qa^2}{E_0t^2} \qquad B538$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.19304.\frac{qa^2}{E_0t^2} \qquad B539$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.56984.\frac{qa}{E_0t} \qquad B540$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = 0.23678.\frac{qa}{E_0t} \qquad B541$$

For square plate, $\beta = 1.5$, $a/t = 70$, $\theta = \mathbf{45^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.067258708.\frac{qa^4}{D_0} \qquad B542$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 1.93892E-05.\ \frac{qa^3}{D_0} \qquad B543$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 2.02363E-05.\frac{qa^3}{D_0} \qquad B544$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00314.\frac{qa^4}{E_0t^3}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -23.29047.\frac{qa^3}{E_0t^2} \qquad B545$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -15.38406.\frac{qa^3}{E_0t^2} \qquad B546$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.12455.\frac{qa^2}{E_0t^2} \quad B547$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.12410.\frac{qa^2}{E_0t^2} \quad B548$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.19281.\frac{qa^2}{E_0t^2} \quad B549$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.56862.\frac{qa}{E_0t} \quad B550$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.23738.\frac{qa}{E_0t} \quad B551$$

For square plate, $\beta = 1.5$, a/t = 80, $\theta = 45^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.066885001.\frac{qa^4}{D_0} \quad B552$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.4824E-05.\ \frac{qa^3}{D_0} \quad B553$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 1.55191E-05.\frac{qa^3}{D_0} \quad B554$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00313.\frac{qa^4}{E_0t^3} \quad B555$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -30.36501.\frac{qa^3}{E_0t^2} \quad B556$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -20.09941.\frac{qa^3}{E_0t^2} \quad B557$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.12446.\frac{qa^2}{E_0t^2} \quad B558$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.12400.\frac{qa^2}{E_0t^2} \quad B559$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.19266.\frac{qa^2}{E_0t^2} \quad B560$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.56782.\frac{qa}{E_0t} \quad B561$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.23778.\frac{qa}{E_0t} \quad B562$$

For square plate, $\beta = 1.5$, $a/t = 90$, $\theta = \mathbf{45^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.066628991.\frac{qa^4}{D_0} \quad B563$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.17015E-05.\frac{qa^3}{D_0} \quad B564$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 1.2276E-05.\frac{qa^3}{D_0} \quad B565$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00312.\frac{qa^4}{E_0t^3} \quad B566$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -38.38270.\frac{qa^3}{E_0t^2} \quad B567$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -25.44384.\frac{qa^3}{E_0t^2} \quad B568$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.12439.\frac{qa^2}{E_0t^2} \quad B569$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.12394.\frac{qa^2}{E_0t^2} \quad B570$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.19256.\frac{qa^2}{E_0t^2} \quad B571$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.56727.\frac{qa}{E_0t} \quad B572$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.23805.\frac{qa}{E_0t} \quad B573$$

For square plate, $\beta = 1.5$, $a/t = 100$, $\theta = \mathbf{45^o}$

$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.066445969.\frac{qa^4}{D_0}$ B574

$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 9.47171E-06.\ \frac{qa^3}{D_0}$ B575

$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 9.95175E-06.\frac{qa^3}{D_0}$ B575

$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00311.\frac{qa^4}{E_0t^3}$ B576

$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -47.34357.\frac{qa^3}{E_0t^2}$ B576

$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -31.41726.\frac{qa^3}{E_0t^2}$ B577

$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\right.$
$\left.\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = \quad -0.12434.\frac{qa^2}{E_0t^2}$ B578

$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\right.$
$\left.\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = \quad -0.12389.\frac{qa^2}{E_0t^2}$ B579

$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\right.$
$\left.\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.19248.\frac{qa^2}{E_0t^2}$ B580

$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.56688.\frac{qa}{E_0t}$ B581

$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = 0.23824.\frac{qa}{E_0t}$ B582

For square plate, $\beta = 1.5$, a/t = 5, $\theta = \mathbf{60^o}$

$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.761720388.\frac{qa^4}{D_0}$ B583

$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 0.008893287.\ \frac{qa^3}{D_0}$ B584

$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 0.006177323.\frac{qa^3}{D_0}$ B585

$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.03562.\frac{qa^4}{E_0t^3}$ B586

$$u = 12\left[1-\mu_{xy}\mu_{yx}\right]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}\ P_2\ S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -0.48056.\frac{qa^3}{E_0t^2} \qquad B587$$

$$v = 12\left[1-\mu_{xy}\mu_{yx}\right]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -0.29559.\frac{qa^3}{E_0t^2} \qquad B588$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = -0.21602.\frac{qa^2}{E_0t^2} \qquad B589$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = -0.62236.\frac{qa^2}{E_0t^2} \qquad B590$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.57755.\frac{qa^2}{E_0t^2} \qquad B591$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 1.33066.\frac{qa}{E_0t} \qquad B592$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.36971.\frac{qa}{E_0t} \qquad B593$$

For square plate, $\beta = 1.5$, $a/t = 10$, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.202741656.\frac{qa^4}{D_0} \qquad B594$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 0.001005648.\ \frac{qa^3}{D_0} \qquad B595$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 0.001381202.\frac{qa^3}{D_0} \qquad B596$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12\left[1-\mu_{xy}\mu_{yx}\right]qa^4}{E_0t^3} \quad = \quad 0.00948.\frac{qa^4}{E_0t^3} \qquad B597$$

$$u = 12\left[1-\mu_{xy}\mu_{yx}\right]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}\ P_2\ S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -1.05484.\frac{qa^3}{E_0t^2} \qquad B598$$

$$v = 12\left[1-\mu_{xy}\mu_{yx}\right]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -0.41963.\frac{qa^3}{E_0t^2} \qquad B598$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = -0.09860.\frac{qa^2}{E_0t^2} \qquad B599$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.28306.\frac{qa^2}{E_0t^2} \quad B600$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.26296.\frac{qa^2}{E_0t^2} \quad B601$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.60188.\frac{qa}{E_0t} \quad B602$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.33066.\frac{qa}{E_0t} \quad B603$$

For square plate, $\beta = 1.5$, $a/t = 20$, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.123952587.\frac{qa^4}{D_0} \quad B604$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.000198437.\frac{qa^3}{D_0} \quad B605$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 0.000426902.\frac{qa^3}{D_0} \quad B606$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00580.\frac{qa^4}{E_0t^3} \quad B607$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -3.24420.\frac{qa^3}{E_0t^2} \quad B608$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -1.69261.\frac{qa^3}{E_0t^2} \quad B609$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.08456.\frac{qa^2}{E_0t^2} \quad B610$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.24328.\frac{qa^2}{E_0t^2} \quad B611$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.22586.\frac{qa^2}{E_0t^2} \quad B612$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.47506.\frac{qa}{E_0t} \quad B613$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.40880\,.\frac{qa}{E_0 t} \quad B614$$

For square plate, $\beta = 1.5$, $a/t = 30$, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.108574473.\frac{qa^4}{D_0} \quad B615$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 8.29807E-05.\ \frac{qa^3}{D_0} \quad B616$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 0.000202178.\frac{qa^3}{D_0} \quad B617$$

$$w = \left(\frac{k_8}{k_T}\right)h\,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00508.\frac{qa^4}{E_0t^3} \quad B618$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -6.72005.\frac{qa^3}{E_0t^2} \quad B619$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -3.95267.\frac{qa^3}{E_0t^2} \quad B620$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.08216.\frac{qa^2}{E_0t^2} \quad B621$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.23662.\frac{qa^2}{E_0t^2} \quad B622$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.21961.\frac{qa^2}{E_0t^2} \quad B623$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.44698.\frac{qa}{E_0t} \quad B624$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.43561.\frac{qa}{E_0t} \quad B625$$

For square plate, $\beta = 1$, $a/t = 40$, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.102996789.\frac{qa^4}{D_0} \quad B626$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 4.5576E-05.\ \frac{qa^3}{D_0} \quad B627$$

$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 0.000116585.\frac{qa^3}{D_0}$ B628

$w = \left(\frac{k_8}{k_T}\right)h\,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00482.\frac{qa^4}{E_0t^3}$ B629

$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -11.54461.\frac{qa^3}{E_0t^2}$ B630

$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -7.14610.\frac{qa^3}{E_0t^2}$ B631

$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.08133.\frac{qa^2}{E_0t^2}$ B632

$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.23433.\frac{qa^2}{E_0t^2}$ B633

$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.21745.\frac{qa^2}{E_0t^2}$ B634

$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.43644.\frac{qa}{E_0t}$ B635

$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.44657.\frac{qa}{E_0t}$ B636

For square plate, $\beta = 1.5$, a/t = 50, $\theta = \mathbf{60^o}$

$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.100371727.\frac{qa^4}{D_0}$ B637

$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 2.88326E-05.\ \frac{qa^3}{D_0}$ B637

$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 7.55151E-05.\frac{qa^3}{D_0}$ B638

$w = \left(\frac{k_8}{k_T}\right)h\,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00469.\frac{qa^4}{E_0t^3}$ B639

$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -17.73414.\frac{qa^3}{E_0t^2}$ B640

$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -11.26123.\frac{qa^3}{E_0t^2}$ B650

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.08094.\frac{qa^2}{E_0t^2} \quad B651$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.23327.\frac{qa^2}{E_0t^2} \quad B652$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.21646.\frac{qa^2}{E_0t^2} \quad B653$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.43141.\frac{qa}{E_0t} \quad B654$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.45196.\frac{qa}{E_0t} \quad B654$$

For square plate, $\beta = 1.5$, $a/t = 60$, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.098933137.\frac{qa^4}{D_0} \quad B655$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.98938E-05.\frac{qa^3}{D_0} \quad B656$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 5.27914E-05.\frac{qa^3}{D_0} \quad B657$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00463.\frac{qa^4}{E_0t^3} \quad B658$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -25.29361.\frac{qa^3}{E_0t^2} \quad B659$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -16.29461.\frac{qa^3}{E_0t^2} \quad B660$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.08074.\frac{qa^2}{E_0t^2} \quad B661$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.23269.\frac{qa^2}{E_0t^2} \quad B662$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.21592.\frac{qa^2}{E_0t^2} \quad B663$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.42863.\frac{qa}{E_0t} \quad B664$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.45498.\frac{qa}{E_0t} \quad B665$$

For square plate, $\beta = 1.5$, $a/t = 70$, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.098061208.\frac{qa^4}{D_0} \quad B666$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.45583E-05.\frac{qa^3}{D_0} \quad B667$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 3.89435E-05.\frac{qa^3}{D_0} \quad B668$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00459.\frac{qa^4}{E_0t^3} \quad B669$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -34.22487.\frac{qa^3}{E_0t^2} \quad B670$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -22.24495.\frac{qa^3}{E_0t^2} \quad B671$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.08061.\frac{qa^2}{E_0t^2} \quad B672$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.23235.\frac{qa^2}{E_0t^2} \quad B673$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.21559.\frac{qa^2}{E_0t^2} \quad B674$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.42694.\frac{qa}{E_0t} \quad B675$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.45683.\frac{qa}{E_0t} \quad B676$$

For square plate, $\beta = 1.5$, $a/t = 80$, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.09749343.\frac{qa^4}{D_0} \qquad \text{B677}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 1.11174E-05.\ \frac{qa^3}{D_0} \qquad \text{B678}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 2.98955E-05.\frac{qa^3}{D_0} \qquad \text{B679}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00456.\frac{qa^4}{E_0t^3} \qquad \text{B680}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -44.52877.\frac{qa^3}{E_0t^2} \qquad \text{B681}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -29.11170.\frac{qa^3}{E_0t^2} \qquad \text{B682}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.08053.\frac{qa^2}{E_0t^2} \qquad \text{B683}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.23213.\frac{qa^2}{E_0t^2} \qquad \text{B684}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.21538.\frac{qa^2}{E_0t^2} \qquad \text{B685}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.42584.\frac{qa}{E_0t} \qquad \text{B686}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = 0.45805.\frac{qa}{E_0t} \qquad \text{B687}$$

For square plate, $\beta = 1.5$, a/t = 90, $\theta = 60^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.097103301.\frac{qa^4}{D_0} \qquad \text{B688}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 8.76851E-06.\ \frac{qa^3}{D_0} \qquad \text{B689}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 2.36644E-05.\frac{qa^3}{D_0} \qquad \text{B690}$$

$$w = \left(\frac{k_8}{k_T}\right) h \,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = \quad 0.00454.\frac{qa^4}{E_0 t^3} \qquad B691$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2 \left[P_2 - \frac{4}{3}\, P_2\, S^2 - 1\right] .S.\left(\frac{k_8}{k_T}\right) .\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -56.20568.\frac{qa^3}{E_0 t^2} \qquad B692$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2 \left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -36.89457.\frac{qa^3}{E_0 t^2} \qquad B693$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.08047.\frac{qa^2}{E_0 t^2} \qquad B694$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.23197.\frac{qa^2}{E_0 t^2} \qquad B695$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = 0.21524.\frac{qa^2}{E_0 t^2} \qquad B696$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.42508.\frac{qa}{E_0 t} \qquad B697$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = 0.45889.\frac{qa}{E_0 t} \qquad B698$$

For square plate, $\beta = 1.5$, a/t = 100, $\theta = \mathbf{60^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.096823809.\frac{qa^4}{D_0} \qquad B699$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 7.0934E-06.\ \frac{qa^3}{D_0} \qquad B700$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 1.91934E-05.\frac{qa^3}{D_0} \qquad B701$$

$$w = \left(\frac{k_8}{k_T}\right) h \,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = \quad 0.00453.\frac{qa^4}{E_0 t^3} \qquad B702$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2 \left[P_2 - \frac{4}{3}\, P_2\, S^2 - 1\right] .S.\left(\frac{k_8}{k_T}\right) .\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -69.25583.\frac{qa^3}{E_0 t^2} \qquad B703$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2 \left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -45.59342.\frac{qa^3}{E_0 t^2} \qquad B704$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2 \left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R \partial Q}\right) = -0.08043.\frac{qa^2}{E_0 t^2} \qquad B705$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.23186.\frac{qa^2}{E_0t^2} \quad B706$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.21513.\frac{qa^2}{E_0t^2} \quad B707$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.42454.\frac{qa}{E_0t} \quad B708$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.45949.\frac{qa}{E_0t} \quad B709$$

For square plate, $\beta = 1.5$, $a/t = 5$, $\theta = 75^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.58807961.\frac{qa^4}{D_0} \quad B710$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.003893428.\frac{qa^3}{D_0} \quad B711$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 0.00529704.\frac{qa^3}{D_0} \quad B712$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.02750.\frac{qa^4}{E_0t^3} \quad B713$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -0.66753.\frac{qa^3}{E_0t^2} \quad B714$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.17555.\frac{qa^3}{E_0t^2} \quad B715$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.04140.\frac{qa^2}{E_0t^2} \quad B716$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.44927.\frac{qa^2}{E_0t^2} \quad B718$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.23217.\frac{qa^2}{E_0t^2} \quad B717$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.58255.\frac{qa}{E_0t} \quad B718$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.31703.\frac{qa}{E_0 t} \quad \text{B719}$$

For square plate, β = 1.5, a/t = 10, θ = 75°

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.282423884.\frac{qa^4}{D_0} \quad \text{B720}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.000644704.\frac{qa^3}{D_0} \quad \text{B721}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 0.002004182.\frac{qa^3}{D_0} \quad \text{B722}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.01321.\frac{qa^4}{E_0t^3} \quad \text{B723}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -1.77113.\frac{qa^3}{E_0t^2} \quad \text{B724}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.55258.\frac{qa^3}{E_0t^2} \quad \text{B725}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.02885.\frac{qa^2}{E_0t^2} \quad \text{B726}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.31500.\frac{qa^2}{E_0t^2} \quad \text{B727}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.16244.\frac{qa^2}{E_0t^2} \quad \text{B728}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.38586.\frac{qa}{E_0t} \quad \text{B729}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.47980.\frac{qa}{E_0t} \quad \text{B730}$$

For square plate, β = 1.5, a/t = 20, θ = 75°

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.17490984.\frac{qa^4}{D_0} \quad \text{B731}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.000117057.\frac{qa^3}{D_0} \quad \text{B732}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 0.000647009.\frac{qa^3}{D_0} \qquad B733$$

$$w = \left(\frac{k_8}{k_T}\right)h\,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00818.\frac{qa^4}{E_0t^3} \qquad B734$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -4.83799.\frac{qa^3}{E_0t^2} \qquad B735$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -2.31725.\frac{qa^3}{E_0t^2} \qquad B736$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = -0.02293.\frac{qa^2}{E_0t^2} \qquad B737$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = -0.25465.\frac{qa^2}{E_0t^2} \qquad B738$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.13057.\frac{qa^2}{E_0t^2} \qquad B739$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.28023.\frac{qa}{E_0t} \qquad B740$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} \quad = 0.61958.\frac{qa}{E_0t} \qquad B741$$

For square plate, $\beta = 1.5$, $a/t = 30$, $\theta = 75^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.14934239.\frac{qa^4}{D_0} \qquad B742$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 4.67554E-05.\ \frac{qa^3}{D_0} \qquad B743$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 0.000306422.\frac{qa^3}{D_0} \qquad B744$$

$$w = \left(\frac{k_8}{k_T}\right)h\,.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00698.\frac{qa^4}{E_0t^3} \qquad B745$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -9.48529.\frac{qa^3}{E_0t^2} \qquad B746$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -5.33510.\frac{qa^3}{E_0t^2} \qquad B747$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = -0.02139.\frac{qa^2}{E_0t^2} \quad \text{B748}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = -0.23912.\frac{qa^2}{E_0t^2} \quad \text{B749}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.12233.\frac{qa^2}{E_0t^2} \quad \text{B750}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.25185.\frac{qa}{E_0t} \quad \text{B751}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.66022.\frac{qa}{E_0t} \quad \text{B752}$$

For square plate, $\beta = 1$, a/t = 40, $\theta = 75^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.139710129.\frac{qa^4}{D_0} \quad \text{B753}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 2.5153E-05.\frac{qa^3}{D_0} \quad \text{B754}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 0.000176531.\frac{qa^3}{D_0} \quad \text{B755}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00653.\frac{qa^4}{E_0t^3} \quad \text{B756}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -15.89379.\frac{qa^3}{E_0t^2} \quad \text{B757}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -9.57594.\frac{qa^3}{E_0t^2} \quad \text{B758}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = -0.02079.\frac{qa^2}{E_0t^2} \quad \text{B759}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = -0.23316.\frac{qa^2}{E_0t^2} \quad \text{B760}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.11917.\frac{qa^2}{E_0t^2} \quad B761$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.24086.\frac{qa}{E_0t} \quad B762$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.67618.\frac{qa}{E_0t} \quad B763$$

For square plate, $\beta = 1$, $a/t = 50$, $\theta = 75^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.135114804.\frac{qa^4}{D_0} \quad B764$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 1.57442E-05.\frac{qa^3}{D_0} \quad B765$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 0.000114273.\frac{qa^3}{D_0} \quad B766$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00632.\frac{qa^4}{E_0t^3} \quad B767$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -24.10282.\frac{qa^3}{E_0t^2} \quad B768$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -15.03337.\frac{qa^3}{E_0t^2} \quad B769$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.02051.\frac{qa^2}{E_0t^2} \quad B770$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.23030.\frac{qa^2}{E_0t^2} \quad B771$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.11765.\frac{qa^2}{E_0t^2} \quad B772$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.23557.\frac{qa}{E_0t} \quad B773$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.68392.\frac{qa}{E_0t} \quad B774$$

For square plate, $\beta = 1.5$, $a/t = 60$, $\theta = 75^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.132580206.\frac{qa^4}{D_0} \qquad B775$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 1.07973E-05.\ \frac{qa^3}{D_0} \qquad B776$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 7.98549E-05.\frac{qa^3}{D_0} \qquad B777$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00620.\frac{qa^4}{E_0t^3} \qquad B778$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -34.12379.\frac{qa^3}{E_0t^2} \qquad B779$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -21.70555.\frac{qa^3}{E_0t^2} \qquad B780$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.02035.\frac{qa^2}{E_0t^2} \qquad B781$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.22872.\frac{qa^2}{E_0t^2} \qquad B782$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.11681.\frac{qa^2}{E_0t^2} \qquad B783$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.23264.\frac{qa}{E_0t} \qquad B784$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.68822.\frac{qa}{E_0t} \qquad B785$$

For square plate, $\beta = 1.5$, a/t = 70, $\theta = 75^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.131038496.\frac{qa^4}{D_0} \qquad B786$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 7.87168E-06.\ \frac{qa^3}{D_0} \qquad B787$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 5.88929E-05.\frac{qa^3}{D_0} \qquad B787$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00613.\frac{qa^4}{E_0t^3} \qquad B788$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -45.96091.\frac{qa^3}{E_0t^2} \qquad B789$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -29.59179.\frac{qa^3}{E_0t^2} \quad B790$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.02026.\frac{qa^2}{E_0t^2} \quad B791$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.22776.\frac{qa^2}{E_0t^2} \quad B792$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.11629.\frac{qa^2}{E_0t^2} \quad B793$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.23085.\frac{qa}{E_0t} \quad B794$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.69085.\frac{qa}{E_0t} \quad B795$$

For square plate, $\beta = 1.5$, $a/t = 80$, $\theta = \mathbf{75^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.130032372.\frac{qa^4}{D_0} \quad B796$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 5.99621E-06.\frac{qa^3}{D_0} \quad B797$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 4.5202E-05.\frac{qa^3}{D_0} \quad B798$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00608.\frac{qa^4}{E_0t^3} \quad B799$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -59.61600.\frac{qa^3}{E_0t^2} \quad B800$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -38.69180.\frac{qa^3}{E_0t^2} \quad B801$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.02019.\frac{qa^2}{E_0t^2} \quad B802$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.22713.\frac{qa^2}{E_0t^2} \quad B803$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.11596.\frac{qa^2}{E_0t^2} \quad B804$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.22968.\frac{qa}{E_0t} \quad B805$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.69257.\frac{qa}{E_0t} \quad B806$$

For square plate, $\beta = 1$, $a/t = 90$, $\theta = 75^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.129340052.\frac{qa^4}{D_0} \quad B807$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 4.72113E-06.\frac{qa^3}{D_0} \quad B808$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 3.57763E-05.\frac{qa^3}{D_0} \quad B809$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00605.\frac{qa^4}{E_0t^3} \quad B810$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -75.08996.\frac{qa^3}{E_0t^2} \quad B811$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -49.00544.\frac{qa^3}{E_0t^2} \quad B812$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.02015.\frac{qa^2}{E_0t^2} \quad B813$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.22669.\frac{qa^2}{E_0t^2} \quad B814$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.11573.\frac{qa^2}{E_0t^2} \quad B815$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.22887.\frac{qa}{E_0t} \quad B816$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.69375.\frac{qa}{E_0t} \quad B817$$

For square plate, $\beta = 1.5$, $a/t = 100$, $\theta = 75^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.128843569.\frac{qa^4}{D_0} \qquad B818$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 3.81445E-06.\ \frac{qa^3}{D_0} \qquad B819$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 2.90143E-05.\frac{qa^3}{D_0} \qquad B820$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00602.\frac{qa^4}{E_0t^3} \qquad B821$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}\ P_2\ S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -92.38325.\frac{qa^3}{E_0t^2} \qquad B822$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -60.53263.\frac{qa^3}{E_0t^2} \qquad B823$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = -0.02012.\frac{qa^2}{E_0t^2} \qquad B824$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = -0.22638.\frac{qa^2}{E_0t^2} \qquad B825$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2h}{\partial R\partial Q}\right) = 0.11556.\frac{qa^2}{E_0t^2} \qquad B826$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.22829.\frac{qa}{E_0t} \qquad B827$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.69460.\frac{qa}{E_0t} \qquad B828$$

For square plate, $\beta = 1.5$, $a/t = 5$, $\theta = 90^o$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.626175259.\frac{qa^4}{D_0} \qquad B829$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 0.002595887.\ \frac{qa^3}{D_0} \qquad B830$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 0.005619383.\frac{qa^3}{D_0} \qquad B831$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.02928.\frac{qa^4}{E_0t^3} \qquad B832$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}\ P_2\ S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -0.86536.\frac{qa^3}{E_0t^2} \qquad B833$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.18900.\frac{qa^3}{E_0t^2} \quad \text{B834}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00614.\frac{qa^2}{E_0t^2} \quad \text{B835}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.02304.\frac{qa^2}{E_0t^2} \quad \text{B836}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.07059.\frac{qa^2}{E_0t^2} \quad \text{B837}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.38841.\frac{qa}{E_0t} \quad \text{B838}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.33632.\frac{qa}{E_0t} \quad \text{B839}$$

For square plate, $\beta = 1.5$, $a/t = 10$, $\theta = \mathbf{90^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.335165887.\frac{qa^4}{D_0} \quad \text{B840}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 0.000441252.\frac{qa^3}{D_0} \quad \text{B841}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 0.002352303.\frac{qa^3}{D_0} \quad \text{B842}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.01567.\frac{qa^4}{E_0t^3} \quad \text{B843}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -2.23110.\frac{qa^3}{E_0t^2} \quad \text{B844}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -0.66621.\frac{qa^3}{E_0t^2} \quad \text{B845}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00401.\frac{qa^2}{E_0t^2} \quad \text{B846}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.01995.\frac{qa^2}{E_0t^2} \quad \text{B847}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.04962.\frac{qa^2}{E_0t^2} \quad B848$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.26409.\frac{qa}{E_0t} \quad B849$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.56314.\frac{qa}{E_0t} \quad B850$$

For square plate, $\beta = 1.5$, $a/t = 20$, $\theta = \mathbf{90^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.201401377.\frac{qa^4}{D_0} \quad B851$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 7.26587E-05.\frac{qa^3}{D_0} \quad B852$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 0.000751566.\frac{qa^3}{D_0} \quad B853$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00942.\frac{qa^4}{E_0t^3} \quad B854$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -5.66990.\frac{qa^3}{E_0t^2} \quad B855$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -2.65774.\frac{qa^3}{E_0t^2} \quad B856$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00261.\frac{qa^2}{E_0t^2} \quad B857$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.01955.\frac{qa^2}{E_0t^2} \quad B858$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.03708.\frac{qa^2}{E_0t^2} \quad B859$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.17394.\frac{qa}{E_0t} \quad B860$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.71970.\frac{qa}{E_0t} \quad B861$$

For square plate, $\beta = 1.5$, $a/t = 30$, $\theta = \mathbf{90^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.168740057.\frac{qa^4}{D_0} \qquad \text{B862}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 2.77621E-05.\ \frac{qa^3}{D_0} \qquad \text{B863}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 0.000353532.\frac{qa^3}{D_0} \qquad \text{B864}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00789.\frac{qa^4}{E_0t^3} \qquad \text{B865}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\,S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -10.80733.\frac{qa^3}{E_0t^2} \qquad \text{B866}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -6.00181.\frac{qa^3}{E_0t^2} \qquad \text{B867}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00224.\frac{qa^2}{E_0t^2} \qquad \text{B868}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.01953.\frac{qa^2}{E_0t^2} \qquad \text{B869}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\ \right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\ \right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.03381.\frac{qa^2}{E_0t^2} \qquad \text{B870}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.14954.\frac{qa}{E_0t} \qquad \text{B871}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.76172.\frac{qa}{E_0t} \qquad \text{B872}$$

For square plate, $\beta = 1.5$, $a/t = 40$, $\theta = \mathbf{90^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.156443403.\frac{qa^4}{D_0} \qquad \text{B873}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 1.46358E-05.\ \frac{qa^3}{D_0} \qquad \text{B874}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 0.000203075.\frac{qa^3}{D_0} \qquad \text{B875}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} \quad = \quad 0.00731.\frac{qa^4}{E_0t^3} \qquad \text{B876}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\,S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -17.88379.\frac{qa^3}{E_0t^2} \qquad \text{B877}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -10.68839.\frac{qa^3}{E_0t^2} \quad B878$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00210.\frac{qa^2}{E_0t^2} \quad B879$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.01953.\frac{qa^2}{E_0t^2} \quad B880$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.03256.\frac{qa^2}{E_0t^2} \quad B881$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.14015.\frac{qa}{E_0t} \quad B882$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.77786.\frac{qa}{E_0t} \quad B883$$

For square plate, $\beta = 1.5$, $a/t = 50$, $\theta = \mathbf{90^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.1505832.\frac{qa^4}{D_0} \quad B884$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 9.06543E-06.\ \frac{qa^3}{D_0} \quad B885$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 0.000131262.\frac{qa^3}{D_0} \quad B886$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00704.\frac{qa^4}{E_0t^3} \quad B887$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -26.94679.\frac{qa^3}{E_0t^2} \quad B888$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -16.71547.\frac{qa^3}{E_0t^2} \quad B889$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00203.\frac{qa^2}{E_0t^2} \quad B890$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.01953.\frac{qa^2}{E_0t^2} \quad B891$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\ \right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\ \right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.03196.\frac{qa^2}{E_0t^2} \quad \text{B892}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.13564.\frac{qa}{E_0t} \quad \text{B893}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.78561.\frac{qa}{E_0t} \quad \text{B894}$$

For square plate, $\beta = 1.5$, $a/t = 60$, $\theta = \mathbf{90^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.14735319.\frac{qa^4}{D_0} \quad \text{B895}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 6.1796E-06.\ \frac{qa^3}{D_0} \quad \text{B896}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 9.16518E-05.\frac{qa^3}{D_0} \quad \text{B897}$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00689.\frac{qa^4}{E_0t^3} \quad \text{B898}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -38.00970.\frac{qa^3}{E_0t^2} \quad \text{B899}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -24.08249.\frac{qa^3}{E_0t^2} \quad \text{B900}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\ \right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\ \right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00200.\frac{qa^2}{E_0t^2} \quad \text{B901}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\ \right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\ \right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.01953.\frac{qa^2}{E_0t^2} \quad \text{B902}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\ \right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\ \right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.03163.\frac{qa^2}{E_0t^2} \quad \text{B903}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.13315.\frac{qa}{E_0t} \quad \text{B904}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.78989.\frac{qa}{E_0t} \quad \text{B905}$$

For square plate, $\beta = 1.5$, $a/t = 70$, $\theta = \mathbf{90^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.145389356.\frac{qa^4}{D_0} \qquad \text{B906}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 4.48825E-06.\ \frac{qa^3}{D_0} \qquad \text{B907}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 6.75586E-05.\frac{qa^3}{D_0} \qquad \text{B908}$$

$$w = \left(\frac{k_8}{k_T}\right) h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = \quad 0.00680.\frac{qa^4}{E_0 t^3} \qquad \text{B909}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -51.07738.\frac{qa^3}{E_0 t^2} \qquad \text{B910}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} \quad = \quad -32.78925.\frac{qa^3}{E_0 t^2} \qquad \text{B911}$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00197.\frac{qa^2}{E_0 t^2} \qquad \text{B912}$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.01953.\frac{qa^2}{E_0 t^2} \qquad \text{B913}$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2 S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3 S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2 S^2 - \frac{4}{3}P_3 S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.03143.\frac{qa^2}{E_0 t^2} \qquad \text{B914}$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.13162.\frac{qa}{E_0 t} \qquad \text{B915}$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3 - 4P_3 S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.79250.\frac{qa}{E_0 t} \qquad \text{B916}$$

For square plate, $\beta = 1.5$, $a/t = 80$, $\theta = \mathbf{90^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} \quad = \quad 0.14410813.\frac{qa^4}{D_0} \qquad \text{B917}$$

$$\phi_x = \left(\frac{k_8}{k_T}\right) P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} \quad = \quad 3.41038E-06.\ \frac{qa^3}{D_0} \qquad \text{B918}$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} \quad = \quad 5.18359E-05.\frac{qa^3}{D_0} \qquad \text{B919}$$

$$w = \left(\frac{k_8}{k_T}\right) h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0 t^3} \quad = \quad 0.00674.\frac{qa^4}{E_0 t^3} \qquad \text{B920}$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}\ P_2\ S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} \quad = \quad -66.15193.\frac{qa^3}{E_0 t^2} \qquad \text{B921}$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -42.83566.\frac{qa^3}{E_0t^2} \quad B922$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00196.\frac{qa^2}{E_0t^2} \quad B923$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.01953.\frac{qa^2}{E_0t^2} \quad B924$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{31}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{32}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{33}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = 0.03130.\frac{qa^2}{E_0t^2} \quad B925$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2 - 4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.13063.\frac{qa}{E_0t} \quad B926$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3\frac{B_{55}}{\beta}(P_3 - 4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.79421.\frac{qa}{E_0t} \quad B927$$

For square plate, $\beta = 1.5$, $a/t = 90$, $\theta = \mathbf{90^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.143226689.\frac{qa^4}{D_0} \quad B928$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 2.68051E-06.\frac{qa^3}{D_0} \quad B929$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\ \frac{qa^3}{D_0} = 4.10173E-05.\frac{qa^3}{D_0} \quad B930$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00670.\frac{qa^4}{E_0t^3} \quad B931$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -83.23435.\frac{qa^3}{E_0t^2} \quad B932$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -54.22168.\frac{qa^3}{E_0t^2} \quad B933$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{11}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{12}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{13}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.00195.\frac{qa^2}{E_0t^2} \quad B934$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\left(B_{21}.\left[P_2 - \frac{4}{3}P_2S^2 - 1\right].\frac{\partial^2 h}{\partial R^2} + \frac{B_{22}}{\beta^2}.\left[P_3 - \frac{4}{3}P_3S^2 - 1\right].\frac{\partial^2 h}{\partial Q^2} + \frac{B_{23}}{\beta}.\left[P_2 + P_3 - \frac{4}{3}P_2S^2 - \frac{4}{3}P_3S^2 - 2\right].\frac{\partial^2 h}{\partial R\partial Q}\right) = -0.01953.\frac{qa^2}{E_0t^2} \quad B935$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.03121.\frac{qa^2}{E_0t^2} \quad B936$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.12995.\frac{qa}{E_0t} \quad B937$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.79538.\frac{qa}{E_0t} \quad B938$$

For square plate, $\beta = 1.5$, $a/t = 100$, $\theta = \mathbf{90^o}$

$$A_1 = \left(\frac{k_8}{k_T}\right)\frac{qa^4}{D_0} = 0.142594675.\frac{qa^4}{D_0} \quad B939$$

$$\phi_x = \left(\frac{k_8}{k_T}\right)P_2.\frac{\partial h}{\partial R}.\frac{qa^3}{D_0} = 2.16301E-06.\frac{qa^3}{D_0} \quad B940$$

$$\phi_y = \left(\frac{k_8}{k_T}\right)\frac{P_3}{\beta}.\frac{\partial h}{\partial Q}\frac{qa^3}{D_0} = 3.32592E-05.\frac{qa^3}{D_0} \quad B941$$

$$w = \left(\frac{k_8}{k_T}\right)h.\frac{12[1-\mu_{xy}\mu_{yx}]qa^4}{E_0t^3} = 0.00667.\frac{qa^4}{E_0t^3} \quad B942$$

$$u = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_2-\frac{4}{3}P_2S^2-1\right].S.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R}.\frac{qa}{E_0} = -102.3252.\frac{qa^3}{E_0t^2} \quad B943$$

$$v = 12[1-\mu_{xy}\mu_{yx}]\left(\frac{a}{t}\right)^2\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{S}{\beta}.\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q}.\frac{qa}{E_0} = -66.94729.\frac{qa^3}{E_0t^2} \quad B944$$

$$\sigma_R = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{11}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{12}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{13}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = -0.00194.\frac{qa^2}{E_0t^2} \quad B945$$

$$\sigma_Q = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{21}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{22}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{23}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = -0.01953.\frac{qa^2}{E_0t^2} \quad B946$$

$$\tau_{RQ} = 12qS.\left(\frac{a}{t}\right)^2\left(\frac{k_8}{k_T}\right).\Big(B_{31}.\left[P_2-\frac{4}{3}P_2S^2-1\right].\frac{\partial^2 h}{\partial R^2}+\frac{B_{32}}{\beta^2}.\left[P_3-\frac{4}{3}P_3S^2-1\right].\frac{\partial^2 h}{\partial Q^2}+\frac{B_{33}}{\beta}.\left[P_2+P_3-\frac{4}{3}P_2S^2-\frac{4}{3}P_3S^2-2\right].\frac{\partial^2 h}{\partial R\partial Q}\Big) = 0.03114.\frac{qa^2}{E_0t^2} \quad B947$$

$$\tau_{RS} = 12q\left(\frac{a}{t}\right)^3 B_{44}(P_2-4P_2S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial R} = 0.12946.\frac{qa}{E_0t} \quad B948$$

$$\tau_{QS} = 12q\left(\frac{a}{t}\right)^3 \frac{B_{55}}{\beta}(P_3-4P_3S^2).\left(\frac{k_8}{k_T}\right).\frac{\partial h}{\partial Q} = 0.79623.\frac{qa}{E_0t} \quad B949$$