

TABLE OF CONTENTS

| <u>DESCRIPTIONS</u> | <u>PAGE</u> |
|--|--------------------|
| ABSTRACT | viii |
| ACKNOWLEDGEMENT | xii |
| CHAPTER I : INTRODUCTION | 1 |
| 1.1 Scope | 1 |
| 1.2 Previous Works | 3 |
| 1.3 Outline of the Present Work | 14 |
| 1.4 Organization | 16 |
| CHAPTER II: NONLINEAR VIBRATIONS OF AXISYMMETRIC THIN CIRCULAR ELASTIC PLATES UNDER THERMAL LOADING | 19 |
| 2.1 Introduction | 19 |
| 2.2 Temperature Distribution | 20 |
| 2.3 Governing Differential Equations | 22 |
| 2.4 Boundary Conditions | 26 |

| | |
|--|----|
| 2.5 Solution | 26 |
| 2.6 Numerical Results, Observations and Discussions | 30 |
| 2.6.1 The effects of Nondimensional Amplitude $\left(\frac{A}{H}\right)$ | 30 |
| 2.6.2 The effects of Thermal Loading | 31 |
| 2.6.3 The effects of Slenderness Parameter $\left(\frac{R}{H}\right)$ | 32 |

**CHAPTER III: NONLINEAR VIBRATIONS OF THIN ELASTIC PLATES
OF VARIOUS SHAPES UNDER THERMAL LOADING.** 38

| | |
|--|----|
| 3.1 Introduction | 38 |
| 3.2. Temperature Distribution | 39 |
| 3.3 Governing Differential Equations | 41 |
| 3.4 Triangular Plates | 42 |
| 3.4.1 Solution | 44 |
| 3.4.2 Numerical Results, Observations and Discussions | 46 |
| 3.4.2.1 The effects of Nondimensional Amplitude $\left(\frac{A}{H}\right)$ | 46 |
| 3.4.2.2 The effects of Aspect Ratio $\left(\frac{a}{b}\right)$ and the Skew Angle (ϕ) | 51 |
| 3.4.2.4 The effects of Thermal Loading | 58 |
| 3.4.2.5 The effects of Slenderness Parameter $\left[\frac{ab}{H^2}\right]$ | 62 |

| | |
|---|----|
| 3.5 Parabolic Plates | 66 |
| 3.5.1 Solution | 67 |
| 3.5.2 Numerical Results, Observations and Discussion | 69 |
| 3.5.2.1 The effects of Nondimensional Amplitude $\left(\frac{A}{H}\right)$ | 69 |
| 3.5.2.3 The effects of Aspect Ratio $\left(\frac{a}{b}\right)$ | 70 |
| 3.5.2.3 The effects of Average Surface Temperature $\left[\frac{T_u + T_b}{2}\right]$ | 71 |
| 3.5.2.4 The effects of Slenderness Parameter $\left(\frac{ab}{H^2}\right)$ | 71 |

**CHAPTER IV: NONLINEAR VIBRATIONS OF NONHOMOGENEOUS
THIN CIRCULAR ELASTIC PLATES UNDER THERMAL
LOADING.**

| | |
|---|----|
| | 81 |
| 4.1 Introduction | 81 |
| 4.2 Temperature Distribution | 82 |
| Case – I: Linear variation of thermal conductivity with temperature | 83 |
| Case – II: Quadratic variation of thermal conductivity with temperature | 84 |
| 4.3 Governing Differential Equations | 85 |
| 4.4 Boundary Conditions | 88 |
| 4.5 Solution | 88 |
| 4.6 Numerical Results, Observations and Discussions | 91 |

| | |
|--|------------|
| 4.6.1 The effects of Temperature-Dependent Coefficient of Thermal Deformation, Modulus of Elasticity, and Poison's ratio | 94 |
| 4.6.2 The effects of Temperature-Dependent Thermal Conductivity | 100 |
| 4.6.3 The effects of Temperature Difference between the Surfaces ($T_u - T_b$) | 100 |
| APPENDIX – 4-A: Solution of Cubic Equation | 104 |
| | |
| CHAPTER V: NONLINEAR VIBRATIONS OF THIN SHALLOW SPHERICAL ELASTIC SHELLS OF VARIABLE THICKNESS. | 106 |
| | |
| 5.1 Introduction | 106 |
| 5.2 Geometry, Coordinate System and Deflection Components | 107 |
| 5.3 Classical Large Deflection Theory (in the von Karman Sense) | 109 |
| 5.3.1 Governing Differential Equations | 109 |
| 5.3.2 Boundary Conditions | 111 |
| 5.3.3 Solution | 111 |
| 5.4 Analysis based on Berger's Approximation | 114 |
| 5.4.1 Governing Differential Equations | 114 |
| 5.4.2 Solution | 116 |
| 5.5 Numerical Results, Observations and Discussions | 118 |
| 5.5.1 The Effect of nondimensional geometrical parameter $\left(\frac{R^2}{2R_0 H_0} \right)$ | 118 |
| 5.5.2 The Effect of thickness parameter (τ) | 126 |
| 5.5.3 The Effect of nondimensional amplitude $\left(\frac{A}{H} \right)$ | 127 |

| | |
|---|------------|
| CHAPTER VI : SUMMARY AND CONCLUSIONS | 130 |
| NOTATIONS AND DEFINITIONS | 142 |
| REFERENCES | 147 |