PREFACE

This thesis consists of ten chapters. The results, in chapters have been numbered in the following manner: (2.6.4) means the result number four of sixth article is in the chapter two.

The references are given at the end of each chapter and quoted in the standard form i.e. [Vol.5, pp.16] means that the page 16 of the fifth volume at the end of chapter is referred.

**In chapter I:**

The introductory remarks and the historical survey of the connected literature are included and some of the standard results are quoted.

**In chapter II:**

An attempt has been made to solve three dimensional unsteady-state thermoelastic problem of thin rectangular plate due to internal heat source and determine temperature distribution, displacement and thermal stresses at any point of thin rectangular plate occupying the region.

D: x ε(-a, a), y ε(-b, b), z ε(-h, h) with third kind boundary and initial condition by applying Marchi-Fasulo transform technique. The results are obtained in terms of infinite series and the numerical calculations are carried out by using Mathematica 5.1 software and shown graphically.

**In chapter III:**

An attempt has been made to solve with three dimensional inverse thermoelastic problem of thin rectangular plate due to internal heat source and determine the unknown temperature distribution, displacement and thermal stresses on edge z = h of the thin rectangular plate due to internal heat source occupying the space

D: −a ≤ x ≤ a, −b ≤ y ≤ b, −h ≤ z ≤ h, with known non-homogeneous third kind boundary and initial condition by applying
Marchi-Fasulo and Laplace transforms technique. The results are applied to the design of useful structure or machines in engineering application. The numerical calculations are carried out by using Mathematica 5.1 software and shown graphically.

In chapter IV:

An attempt has been made to solve with three dimensional inverse thermoelastic problem of semi-infinite solid rectangular plate due to internal heat source occupying the space $D$: $0 \leq x < \infty, 0 \leq y < \infty, 0 \leq z \leq h$ and determine the unknown temperature distribution, displacement and thermal stresses on edge $z=h$ of the rectangular plate due to internal heat source with known third kind boundary and initial condition by applying Fourier and Laplace transforms technique. The results are obtained in terms of infinite series and the numerical calculations are carried out by using Mathematica 5.1 software and shown graphically.

In chapter V:

An attempt has been made to solve the inverse unsteady-state thermoelastic problem of thin annular disc with internal heat source, where the heat is dissipated by convention from the boundary surfaces at $r = a$ and $r = b$ in to surrounding varies position and time on curved surfaces and at lower plane surface heat is dissipated to surrounding at zero temperature. The finite Marchi-Zgrablich and Laplace transforms are used to obtain the numerical result. The series solution convergent since the length of annular disc is very small. The unknown temperature, displacement and thermal stresses that are obtained can be applied to the design of useful structures or machines in engineering application.

In chapter VI:

An attempt has been made to solve two dimensional non-homogeneous radiation boundary value problem of circular annular fin
with heat source occupying the space \( D = \{(x, y, z) \in \mathbb{R}^3: a \leq r \leq b, 0 \leq z \leq l\} \), where \( r = \sqrt{x^2 + y^2} \) the material of fin is isotropic homogeneous and all properties are assumed to be constant and the temperature distribution, displacement and stress function for annular fin have been obtained. We developed the analysis for temperature field for heating processes by using Marchi-Zgrablich and Laplace transforms technique with boundary condition of radiation type. The series solution is converges since the thickness of annular fin is very small. Any particular case of special interest may be derived by assigning suitable value of the parameter and function in the series expansion. The result can be applied to the design of useful structures or machines in engineering applications.

**In chapter VII:**

An attempt has been made to solve the completely the inverse unsteady-state thermoelastic problem of finite length thick hollow cylinder occupying the space \( D: a \leq r \leq b, 0 \leq z \leq h \) with internal heat source where the heat is dissipated by convention from the boundary surfaces at \( r=a \) and \( r=b \) in to surrounding varies position and time on curved surfaces and at lower plane surface heat is dissipated to surrounding at zero temperature. The finite Marchi-Zgrablich and Laplace transforms are used to obtain the numerical result. The unknown temperature, displacement and thermal stresses that are obtained can be applied to the design of useful structures or machines in engineering applications.

**In chapter VIII:**

An attempt has been made to solve two dimensional non-homogeneous boundary value problem of heat conduction and determination of temperature and the thermal deflection in a semi-
infinite hollow cylinder occupying the space $D$: $a \leq r \leq b, 0 \leq z < \infty$, for $t > 0$ heat generated within the semi- infinite hollow cylinder at rate $g(r,z,t)$, the conduction equation has been solved by using Marchi-Zgrablich and Fourier transforms technique. The problem is very important in view of its relevance to various industrial machines subjected to heating such as the main shaft of lathe, turbines and the role of rolling mill and the numerical calculations are carried out by using Mathematica 5.1 software and shown graphically.

**In chapter IX:**

An attempt has been made to solve thermoelastic problem of semi-infinite solid cylinder occupying the space $D$: $0 \leq r \leq b, 0 \leq z < \infty$, the lower boundary surface is kept insulated and upper surface of the cylinder is at initial temperature while heat is dissipated by convection from boundary surface at $r = b$ in to a medium at zero temperature and results are obtain in term of Bessel function in order to obtain the temperature distribution and stresses and we analyze particular case with mathematical model and numerical calculations are carried out by using Hankel and Fourier transforms technique. We may calculate that the system of equation in this study can use to design of useful structures or machines in engineering applications.

**In chapter X:**

An attempt has been made to solve thermoelastic problem of non-homogeneous unsteady-state boundary value problem of heat conduction is considered and the thermoelasticity of thick circular plate is defined as $D$: $0 \leq r \leq a, -h \leq z \leq h$. This problem deals with the determination of the temperature, displacement and radial and angular thermal stresses under the unsteady-state temperature field due to heat generation and we analyze particular case with mathematical model for $\psi(y) = -y$ and numerical calculations are carried out by using Marchi-Fasulo and
Hankel integral transforms technique. The result presented here will be useful in engineering problem particularly in the determination of the state of stress in a thick circular plate. The numerical calculations are carried out by using Mathematica 5.1 software and shown graphically.

The list of published research papers, research papers accepted for publication and papers communicated for publication and conferences attended/papers presented is given in the appendix.

**APPENDIX**

**List of Papers Published**

1. **C.M. Jadhav, B.R.Ahirrao and N.W.Khobragade**

2. **C.M. Jadhav, B.R.Ahirrao and N.W.Khobragade**

3. **C.M. Jadhav, B.R.Ahirrao and N.W.Khobragade**
4. **C.M. Jadhav** and B.R.Ahirrao


5. **C.M. Jadhav** and B.R.Ahirrao


6. **C.M. Jadhav**


7. **C.M. Jadhav** and B.R.Ahirrao


**List of Papers Communicated**

1 **C.M. Jadhav and B.R.Ahirrao:**

“A transient thermoelastic problem of thin finite rectangular plate with heat source by Marchi-Fasulo transforms technique”, *Pelagia Research Library, Advances in Applied Science Research, ISSN 0976-9610(USA)*

2 **C.M. Jadhav and B.R.Ahirrao:**

Conferences attended

2. *National conference of the Indian Mathematical* (IMS), School of Mathematical Sciences, SRTM University, Nanded.
3. National conference on mathematical Sciences, School of Mathematical Sciences, North Maharashtra University, Jalgaon.

Papers presented