The research in the field of vibration is fascinating and continually acquiring importance in the modern science and engineering curricula as it plays an important role in almost every field of applied science today. In modern science, particularly in engineering we can not move without considering the effect of vibrations because almost all of the machines and engineering structures experience vibrations.

Thermally induced vibrations of elastic plates are of great interest in aircraft, machine designs, nuclear and aeronautical engineering. Hence the interest in the effect of temperature on solid bodies has been increased in recent years in the developments of space technology. In these problems the thermal dependence of frequency on plates of different shapes are of great importance.

Therefore, the subject matter of the thesis has been confined to a close study of vibration problems of isotropic, non-homogeneous infinite and circular plates of uniform and variable thickness, having simple and mixed boundary conditions taking into account the effect of Winkler elastic foundation, shear deformation and rotatory inertia under the influence of various temperature fields.

The present work is a humble contribution towards the study of thermal vibrations of isotropic, elastic plates of variable and uniform thickness. The whole range of the subject of study is covered in six chapters, which deal
with the thermal transverse vibrations of isotropic, elastic, non-homogeneous infinite and circular plates of variable and uniform thickness resting on an Winkler elastic foundation. The effects of transverse shear and rotatory inertia on thermal vibrations in these plates have also been studied. The derivation of frequency equations and displacement functions for the isotropic, elastic, non-homogeneous plates of variable and uniform thickness and their solutions for different combinations of boundary conditions under the influence of different types of varying transient temperature fields, comprise the details of these chapters. Using high speed digital computer P-HT, numerical results for frequencies corresponding to first two modes of vibration of variable and uniform thickness have been computed for different values of the taper constant, foundation parameter and thermal gradient

These results have been presented both in tabular and graphical forms. The results obtained in this study, after taking the thermal gradient, foundation parameter and taper constant as zero, are reduced to those for isotropic, homogeneous plates of uniform thickness. These results are in good agreement with the results already published.

The survey of literature on vibration problems of isotropic, non-homogeneous, elastic, infinite, circular and rectangular plates of variable and uniform thickness with shear effect and elastic foundation under the influence of various types of temperature fields is carried out in the Central library of I.I.T. Roorkee, C.B.R.I. Roorkee, G.K.U., Kankhal (Haridwar) and C.C.S. University Meerut, chapter-wise summary of the thesis is given below:
CHAPTER-I

Effects of transverse shear deformation and rotatory inertia on the frequencies of vibration of an isotropic, elastic, non-homogeneous infinite plate of linearly varying thickness under the influence of linearly transient distributed temperature field have been studied. The plate is assumed to be subjected to a linearly temperature distribution field along $X$- axis.

The differential equations of motion of the rectangular plate on the basis of shear theory have been derived and then applied for non-homogeneous infinite plate. The governing differential equations of motion have been solved by Frobenius method by taking the transverse displacement and the local rotation of the plate in a power series.

Numerical results for frequencies corresponding to the first two modes of vibration are computed for various values of taper parameter and thermal gradient with different combinations of boundary conditions, such as clamped-clamped and clamped-simply supported. The results, so obtain, are presented graphically in this chapter.

CHAPTER-II

The present chapter deals with the study of linearly transient distributed temperature field on the vibrations of an isotropic, non-homogeneous infinite plates of parabolically varying thickness under the effect of transverse shear deformation and rotatory inertia.
The modulii of elasticity vary linearly under the influence of transient distributed temperature field. The non-homogeneity of the material of the plates is raised mainly due to the variation of Young's modulus and Shear modulus, where as the Poisson's ratio remains constant and mass density is also assumed to vary due to temperature effect.

The governing differential equations of motion have been solved by Frobenius method by expressing the transverse displacement and rotation of the plate in infinite series. The numerical values for frequencies corresponding to first two modes of vibration are computed for different value of thermal gradient and taper constant with clamped-clamped and clamped-simply supported edge conditions of the plate.

A comparison between the numerical results for homogeneous and non-homogenous materials of the plate is also made.

CHAPTER-III

The influence of parabolically transient distributed temperature field in X-direction on the flexural vibrations of an isotropic, elastic, non-homogeneous infinite plate of uniform thickness resting on an Winkler elastic foundation under the transverse shear deformation and rotatory inertia have been studied here on the basis of shear theory.

The plate is assumed to be subjected to a parabolically temperature distribution field along X-axis. The non-homogeneity of the plate is raised due
to the variation of modulii of elasticity under parabolically temperature field where as Poisson’s ratio and mass density of the plate materials remains constants.

The differential equations of motion of the rectangular plate on the basis of shear theory have been derived and then applied for non-homogeneous infinite plate. The governing differential equations of motion have been solved by Frobenius method by taking the transverse displacement and the local rotation of the plate in a power series. Numerical results for frequencies corresponding to first two modes of vibration have been computed for the different combinations of the value of thermal gradient and foundation parameter with clamped-clamped and clamped-simply supported edge conditions of the plates.

The numerical results for homogeneous and non-homogeneous material of the plate have been compared.

CHAPTER-IV

In this chapter the effects of transverse shear deformation and rotatory inertia on flexural vibrations of isotropic, elastic circular plates of variable thickness under the influence of linearly varying transient temperature field in radial direction have been studied.

The modulii of elasticity are assumed to vary linearly with transient distributed temperature field. The Mindlin’s equations of motion have been used for the plates of linearly varying thickness and solved by the method of
Frobenius. The transverse displacement and rotation of the plates are expressed as an infinite series in terms of the radial coordinate.

The frequencies corresponding to the first two modes of vibration have been computed for the circular plate with clamped and simply-supported edge conditions for various values of thermal gradient and taper constant. The numerical results so obtained are compared with the published results where the thermal gradient and taper constant are zero.

CHAPTER-V

The influence of linearly transient distributed temperature field in radial direction on the flexural vibrations of an isotropic, elastic non-homogeneous circular plate of parabolically varying thickness have been observed on the basis of shear theory under the effect of shear deformation and rotatory inertia.

The non-homogeneity of the material of the plates is assumed to arise due to the variation of the shear modulus and Young's modulus, which depends upon the thermal effect with radius vector and mass density of the plate materials are assumed to vary as well as above. Where as Poisson's ratio of the plate remains constant.

The governing differential equations of motion are solved by the Frobenius method. The transverse displacement of the plate has been expressed as the power series in terms of the radial coordinates the numerical results for

\[ x \]
frequencies corresponding to the first two modes of vibration have been computed for the different combinations of the value of thermal gradient and taper parameter with clamped and simply-supported edge conditions of the plates. The results, so obtaining are presented in tabular graphical form in this chapter.

CHAPTER VI

Effects of transverse shear deformation and rotatory inertia on the frequencies of flexural vibrations of an isotropic, non-homogeneous circular plate of uniform thickness under the influence of parabolically transient distributed temperature field have been studied.

The non-homogeneity of the plate material of the plate is assumed to arise due to variation of Young’s modulus and Shear modulus under the influence of thermal effect with the radius vector, whereas Poisson’s ratio and mass density of plate material are assumed to remain constants.

The Mindlin’s equations of motion have been used for the plates of uniform thickness and are solved by the method of Frobenius. The transverse displacement and the local rotation of the plate are expressed as an infinite series in terms of the radial coordinates. The frequencies corresponding to the first two modes of vibration have been computed for different values of thermal gradient and foundation parameter for clamped and simply-supported combination of edge conditions.

The numerical results so obtained are compared with the results
obtained on the basis of classical plate theory for homogeneous as well as non-homogeneous material of the plate.

Scope of vibration problems of elastic plates is very much comprehensive owing to plates of various geometrical shapes with complications of anisotropy, non-homogeneity, in-plane forces, surrounding media, large deflections, uniform and non-uniform thickness, elastic foundation, thermal effect, loading effect, rotating effect, damping effect, shear deformation and rotatory inertia, besides holes, added masses, simple and mixed boundary conditions.

As a matter of fact, the design of machines and other engineering structures require consideration of their dynamic behaviour, as most of these structures experience vibrations. With the advancement of engineering technology, the use of constructions of variable thickness has increased because of the considerations of its safety, economy and durability. The use of plates of variable thickness in telephone, industry, nuclear reactor technology, naval structures, aeronautical fields and machine designs is very common. The other examples of practical applications for structural engineers, the study of the effect of vibrations is most significant for the multi-storey building and tall structures. The study of vibrational response in discs is also equally significant in turbomachines, mirrors and lenses in optical system and electro-mechanical transducer for the electronic telephones.

Thermally-induced vibrations of elastic plates are of great interest in aircraft and machine designs and nuclear and aeronautical engineering. Hence the interest