

PREFACE

The present thesis deals mainly with some problems of practical interest in the field of structural and mechanical engineering. The topic covers a wide area in theoretical conception which is beyond the expectation of one's objective to investigate into every aspect of the topic. Hence the present author restricts herself mainly to some problems related to the static and dynamic behaviour of structures, to be more precise, plate and shell structures are considered for illustrative examples.

Considering the importance of vibrational characteristic of structures, the nonlinear analysis of elastic plates and shells received considerable attention in literature since the sixth decade of 20th century. In general Karman type field equations are employed for almost all types of structures. Several methods are available to investigate the static and dynamic response of structures amongst which the "Constant Deflection Contour" method needs special mention. This method has been previously developed by Mazumdar, however the most of his investigations were restricted to linear analysis only. The present thesis aims at extending this method to the nonlinear analysis of plates vibrating at large amplitudes in conjunction with Galerkin procedure. Illustrations of the present studies have been considered to cover those problems which are either new investigations or treated with this new approach to previously investigated problems. The results of the present investigations have always been compared to known available results so far as possible. Starting from structure having regular and common boundaries gradually more and more complicated structures and mixed boundary value problems have been included in the present thesis.

The first chapter concerns with the comprehensive study of the early researches in the area under investigation and with an introduction of the basic need of such problems arising out of the future demand of the twenty first century. A review of the early investigations is cited chronologically so far as possible.

The second chapter contains the basic nonlinear theory of elasticity. This theory constitutes the main frame of operation for the present investigation under consideration.

In the third chapter different methods for solving the non-linear problems have been discussed with their merits and demerits. The third chapter also includes some preliminary remarks about the "Constant Deflection Contour" method.

In all problems considered from Chapter IV the basic governing differential equations have been deduced primarily on the basis of Karman field equations extended to a dynamic case. In chapter IV, a simplified method for solving nonlinear problems using "Constant Deflection Contour" method has been discussed.

The first problem (Chapter IV) aims at investigating the static and dynamic behaviour of elliptic plates clamped along its boundary. Large vibrations of elliptic plates on elastic foundation have been discussed in the second problem of chapter IV. In problem -3 (Chapter IV), the static and dynamic behaviour of elliptic plates under damping condition is discussed using Berger's hypothesis. Attempts have also been made to justify the use of Karman field equations over other simplified or modified equations. Problem 4, (chapter IV) concerns with effect of varying flexural rigidity on nonlinear vibrations of circular and elliptical plates.

In chapter V, a modified method for solving the nonlinear problems is discussed some

typical examples have been discussed with some more complicated problems. These illustrations not only support the proposed theory but also establish the accuracy of numerical results for mixed boundary value problems.

In chapter VI the extension of "Constant Deflection Contour" method to shell structures has been made to break the monotony of plate structures.

In Chapter VII an attempt has been made to extend the present analysis to elastic plastic shells structures.

At last the author has tried to refer all relevant papers published so far. However none can avoid omissions when choosing a few out of thousands of papers, but any omissions is absolutely unintentional.

English being the second language of the author, she begs apology beforehand for any linguistic error or absence of any proper expression of the text that may creep-in in the preparation of the work.

The author expresses her heartiest gratefulness to her guide Dr. M.M. Banerjee [Ex Reader, A.C. College, Jalpaiguri, West Bengal, India]. Without his help it would not have been possible for her to complete the thesis.