STRUCTURAL OPTIMISATION BY MATHEMATICAL PROGRAMMING

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Abstract

In the recent past nonlinear programming techniques and dynamic programming techniques have been applied with considerable success to the optimal designs of discrete structures such as framed structures. By nature of these problems the number of design variables involved would be finite. The present work is concerned with the application of such numerical optimisation techniques to some problems in continuum mechanics, where the design variables are continuous and an infinite number of parameters would be needed to describe the problems completely. A special emphasis has been placed on the minimum weight designs and the problems considered are the designs of axisymmetric plates and shells by statical considerations. The work considers the plastic minimum weight designs of circular plates subject to various types of loadings and of spherical caps subject to concentrated loads are their vertices. Three particular cases of designs have been considered, viz. designs for continuously varying thickness, for piecewise constant thicknesses for uniform thickness.

Chapter 1 gives a brief introduction and brief details of various topics involved in the study. Chapter 2 considers the basic formulation of the problems under investigation; it also considers the solutions to the sandwich plates with continuously varying thickness by techniques of calculus of variations.

Chapter 3 considers in some detail the application of the nonlinear programming techniques to the solutions to the problems. The problems are expressed in terms of a finite number of parameters as nonlinear programming problems by use of the finite element method. An attempt has been made to solve these problems by some well known nonlinear programming techniques.

Chapter 4 considers the application of the dynamic programming techniques to the problems of designs for continuously varying thickness. Chapter 5 sums up the observations on the present study.