

Preface

This monograph concerns with analysis of thin annular elastic/plastic discs of constant thickness subject to mechanical and thermal loading under plane stress conditions. The flow theory of plasticity is used. The presentation of the introductory material and the theoretical developments appear in a text of three chapters. The topics chosen are primarily of interest to engineers as postgraduates and practitioners but they should also serve to capture a readership from among applied mathematicians. The monograph provides both a description of a general approach to finding the distribution of stresses and strains in thin discs and a collection of analytic and semi-analytic solutions. Many solutions are represented by formulae. Such solutions are immediately ready for practical use. Other solutions are illustrated by diagrams. These diagrams demonstrate most important tendencies in solutions behaviour. It is however evident that they cannot be used for practical calculation of stress and strain distributions. Therefore, most of such solutions are described in great detail. In most cases, numerical techniques are only necessary to evaluate integrals and solve transcendental equations. For reasons of space, the main focus is on mechanical and thermal loading, though the general approach can be extended to thermo-mechanical loading without any difficulty.

Among the topics that are either new or presented in greater detail than would be found in similar texts are the following:

1. A general approach to calculate the distribution of stresses and strains in thin annular discs for the von Mises yield criterion and its associated flow rule.
2. A general approach to calculate the distribution of stresses and strains in thin annular discs for Hill's quadratic anisotropic yield criterion and its associated flow rule.
3. A general approach to calculate the distribution of stresses and strains in thin annular discs for Drucker–Prager yield criterion and two flow rules.
4. Analytic and semi-analytic solutions for thin annular discs under specific loading conditions of practical interest.

The first chapter concerns the general approach to calculate the distribution of stresses and strains in thin elastic/plastic discs. In particular, general solutions

for stresses and strains are given for three widely used yield criteria. These are the von Mises yield criterion, Hill's quadratic anisotropic yield criterion and Drucker–Prager yield criterion for pressure-dependent materials. In all cases, the associated flow rule is used to connect stresses and plastic strain rates. In addition, plastically incompressible material is considered in case of the Drucker–Prager yield criterion. These general solutions are used in subsequent chapters.

Chapter 2 deals with thin annular discs subject to internal or external pressure. Analytic or semi-analytic solutions are proposed for each of the aforementioned yield criteria.

In Chap. 3, it is assumed that disc inserted into a container is subject to thermal loading. As in the case of mechanical loading, analytic or semi-analytic solutions are proposed for each of the aforementioned yield criteria.

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