**Book Reviews**


**REVIEWED BY C. O. HORGAN**

This book is described on its back cover as "a first year graduate textbook in Linear Elasticity, being based on a one semester course taught by the author at the University of Michigan. It is written with the practical engineering reader in mind, dependence on previous knowledge of Solid Mechanics, Continuum Mechanics or Mathematics being minimized. Most of the test should be readily intelligible to a reader with an undergraduate background of one or two courses in elementary Strength of Materials and a rudimentary knowledge of partial differentiation. Emphasis is placed on engineering applications of elasticity and examples are generally worked through to final expressions for the stress and displacement fields in order to explore the engineering consequences of the results. The topics covered were chosen with a view to modern research applications in Fracture Mechanics, Composite Materials, Tribology and Numerical Methods. Thus, significant attention is given to crack and contact problems, problems involving interfaces between dissimilar media, thermoelasticity, singular asymptotic stress fields and three-dimensional problems. Problems suitable for class use are included at the end of most of the chapters. These are expressed wherever possible in the form they would arise in Engineering—i.e. as a body of a given geometry subjected to prescribed loading—instead of inviting the student to “verify” that a given candidate stress function is appropriate to the problem. The text is therefore written in such a way as to enable the student to approach such problems deductively.”

The book is in three parts: I General Considerations (2 chapters), II Two-Dimensional Problems (12 chapters), III Three-Dimensional Problems (11 chapters). Part I consists of 28 pages outlining notation and developing the equilibrium equations and compatibility conditions. Part II (156 pages) provides extensive treatment of the plane strain and plane stress problems of linear isotropic elastostatics. The extent of coverage can be gleaned from the chapter titles: 3 Plane strain and plane stress; 4 Stress function formulation; 5 Problems in rectangular coordinates; 6 End effects; 7 Body forces; 8 Problems in polar coordinates; 9 Calculation of displacements; 10 Curved beam problems; 11 Wedge problems; 12 Plane contact problems; 13 Forces, dislocations and cracks; 14 Thermoelasticity. Part III (102 pages) covers a number of topics in three-dimensional elasticity: 15 Displacement function solutions; 16 The Boussinesq potentials; 17 Thermoelastic displacement potentials; 18 Singular solutions; 19 Spherical harmonics; 20 Axisymmetric problems, 21 Frictionless contact; 22 The boundary value problem; 23 The Penny-shaped crack; 24 The interface crack; 25 The Reciprocal theorem.

From the foregoing, it can be seen that this book covers a variety of topics of contemporary interest in linear isotropic elastostatics. The emphasis throughout is on applications, rather than theory. The most important areas are covered, with the exclusion of complex variable methods which the author states "would need most of a book of this length to itself." The book is clearly written, the problems considered are well motivated and it is certainly suitable as a graduate textbook. It is a viable alternative to the book of Timoshenko and Goodier and may, indeed, be regarded as a modern version of this classic.


**REVIEWED BY Z. MRÓZ**

The present book provides a comprehensive introduction to plasticity and creep of materials and structures. It is addressed to students of applied mechanics and can be used within mechanical and civil engineering undergraduate or graduate programs. The present version originated from the Polish edition of 1986, which was based on courses taught by the author at the Cracow Technical University.


Part I is composed of two chapters: Stress and Strain State, and Finite Deformations. First, the stress and linear strain tensors are introduced and equilibrium and compatibility equations are derived. The principal stress and strain components are determined together with principal invariants. Next, the finite strain tensors of Green and Almansi are introduced in both rectangular and curvilinear coordinates. The Cauchy and Piola-Kirchhoff stress tensors are also briefly discussed with respective equilibrium and virtual work equations.

Part II consists of three chapters: Basic Equations of Perfect Plasticity, Basic Equations of Plastic Hardening, and Methods of the Theory of Plasticity. The fundamental assumptions of the perfectly plastic model are outlined with several yield conditions discussed in detail. The flow rule and the Hencky deformation theory are next introduced and their applicability is illustrated. For hardening description isotropic, kinematic, and combined hardening models are introduced. The concepts of cyclic plasticity and shake down are briefly...
reviewed. The last chapter of this part deals with elasto-plastic and limit analysis of structural elements. The author makes distinction between the analysis at point, cross-sectional, and global levels, by introducing proper generalized stresses and strains. The stabilizing and destabilizing geometric effects are illustrated by considering limit states of thin walled tubes and trusses. The theorems of limit analysis and shake down are demonstrated and applied to a class of problems for beam structures, plane strain, and plane stress.

Part III concerned with solutions of elastic-plastic problems is devoted to torsion and bending (Chapter 6) and to analysis of cylinders, disks, and plates (Chapter 7). Such particular problems are treated as elastic-plastic torsion of prismatic bars, bending of beams and frames, analysis of thick-walled tubes, spherical shells and disks, and, finally, with limit analysis for plates using mostly kinematic approach and yield line methods.

Part IV provides foundations of creep models. Chapter 8 is devoted to a detailed discussion of uniaxial creep models including nonlinear viscous models, viscoelastic integral and differential description, and, finally, viscoplastic models. Chapter 9 provides a brief exposition of multiaxial creep models based on viscous potentials and evolution rules for isotropic and kinematic hardening. The viscoelastic integral representation for multiaxial states is also briefly discussed.

Part V provides some illustrative solutions of creep problems. In particular, Chapter 10 is concerned with bending, buckling, and torsion of bars with a variety of examples treated analytically. Chapter 11 is devoted to axially symmetric creep problems such as steady and transient creep of thick-walled tubes.

Part VI is concerned with creep rupture phenomenon and its modeling. In Chapter 12 the exposition of constitutive equations of creep rupture is provided. The creep rupture data for a variety of steels and alloys are provided, and classical theories of ductile and brittle rupture are discussed, and their application is provided in Chapter 13 dealing with brittle rupture of tubes and disks. The problem of optimal design against creep rupture by varying disk thickness and its prestress is considered and some rational designs are demonstrated.

The book has a very broad scope and its value lies mainly in numerous illustrative examples treating plasticity and creep problems. The material contained is too large to be used in one course, but it could easily be selected to fit the specific purpose. The text provides a balanced introduction to inelastic response of materials and analysis of structural elements, accounting for small and large inelastic strains. The book can be useful for teachers and students who can find not only clear subject exposition but also inspiration for new research topics only briefly covered in the book. For instance, the phenomenon of decohesive capacity of disks and shells is related to strain localization effect and post-critical response (cf. Chapter 5) that could be studied extensively by numerical techniques. Similarly, the optimal design with creep rupture constraint calls for further study, both experimental and numerical (cf. Chapter 13). Also, the geometric hardening and softening effects on limit interaction surfaces need further research. The extensive reference list provides proper source for a more profound study of selected topics.

The book is recommended as a valuable text for teaching and research purposes.