Journal of Applied Mechanics

Book Reviews

Elasticity, by J. R. Barber. Kluwer. Dordrecht, 1992. 293 pages. Price: $119.00.

REVIEWED BY C. O. HORGAN[1]

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.

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Plasticity and Creep, by J. J. Skrzypek (English ed. edited by R. B. Hetnarski). CRC Press, 1993. 542 pages.

REVIEWED BY Z. MRÓZ[2]

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.

The book is divided into six parts: I Basic Definitions, pp. 1–36; II Foundations of Plasticity, pp. 37–235; III Solutions of Elastic-Plastic Problems, pp. 235–355; IV Foundations of Creep, pp. 355–425; V Solution of Creep Problems, pp. 425–465; VI Creep Rupture, pp. 465–511.

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

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Creep - Plasticity. Posted May 15, 2013, 7:11 AM EDT Structural Mechanics & Thermal Stresses Version 5.1 6 Replies. Gudrun Kissinger.Â The difference between creep and plasticity can be seen if you increase your load fast to constant value. An elastoplastic material deforms immediately, and then the strains are constant. A material which exhibits creep will deform continuously under a constant load. The nonequilibrium dynamics of diusion-mediated plasticity and creep in materials subjected to constant load at high homologous temperatures is studied atomistically using Phase Field Crystal (PFC) methods. Creep stress and grain size exponents obtained for nanopolycrystalline systems, m 1.02 and p 1.98, respectively, closely match those expected for idealized diusional Nabarro-Herring creep. If creep and plasticity occur simultaneously and implicit creep integration is in effect, both behaviors may interact and a coupled system of constitutive equations needs to be solved. If creep and plasticity are isotropic, Abaqus/Standard properly takes into account such coupled behavior, even if the elasticity is anisotropic. However, if creep and plasticity are anisotropic, Abaqus/Standard integrates the creep equations without taking plasticity into account, which may lead to substantial errors in the creep strains. In physics and materials science, plasticity, also known as plastic deformation, is the ability of a solid material to undergo permanent deformation, a non-reversible change of shape in response to applied forces. For example, a solid piece of metal being bent or pounded into a new shape displays plasticity as permanent changes occur within the material itself. In engineering, the transition from elastic behavior to plastic behavior is known as yielding. uniï¬ed creepâ€“plasticity model capable of predicting. cyclic non-isothermal loading conditions is of extreme. importance.Â ature creep and plasticity of Ni-based single crystal. superalloy are octahedral {1 1 1}(1 1 0) and cube. {0 0 1}(1 10) crystallographic slip.