Book Reviews

Continuum Theory of the Mechanics of Fibre-Reinforced Composites,

A.J.M. Spencer, Editor, Springer-Verlag, Inc., New York, 1984, 284 pp., $25.30.

During the last two decades, significant advances have been made in the development of continuum mechanical theories for the analysis of the mechanical behavior of fiber-reinforced composites. Much of this material is scattered in a variety of journals and symposium proceedings. The present monograph is a timely and welcome addition to the small list of books that are currently available on the subject.

The ten articles in the book are based on the five authors' lectures at the International Centre for Mechanical Sciences in Udine, Italy in July 1981. According to the editor, "the lecture notes are concerned with the formulation of equations to describe the mechanical behavior of fibre-reinforced materials having various kinds of material response, and with the application of these equations to the solution of problems of practical and theoretical interest." This is an accurate statement of the book's goals and accomplishments, subject to the unavoidable limitations imposed by its size. Although the choice of topics has been clearly influenced by the expertise of the editor and the authors, some of the most fundamental and important aspects of the subject can be found in the book.

Fiber-reinforced composites are distinguished by their strongly anisotropic macroscopic behavior, and a detailed knowledge of the constitutive relations is the most important ingredient in their continuum mechanical treatment. This is the topic of discussion in the first article by the editor. The various possible forms of these relations for linear elastic, nonlinear elastic, and rigid-plastic behavior are carefully discussed with special emphasis on composites containing a single family or two families of (parallel) fibers.

Formulation and/or solution of a number of specific problems are considered in the subsequent articles. T.G. Rogers deals with the plane-strain finite deformation of the so-called ideal fiber-reinforced materials (IFRM), which are subject to the constraints of fiber inextensibility and bulk incompressibility. The presence of discontinuities and singularities in certain stress components under particular loading conditions are indicated. These unusual properties are further analyzed in a subsequent treatment by A.C. Pipkin.

Solutions of a number of standard boundary-value problems of plane linear elasticity are given by E.H. England, and include cracks and holes in IFRM. A later chapter by T.G. Rogers is concerned with the deformation of hollow cylinders which are continously reinforced by two families of helically wound inextensible fibers. Other articles involve the linear elastic fracture mechanics of composites reinforced by two orthogonal families of inextensible fibers (Pipkin), the problem of the reinforcement of holes in isotropic plates by means of fiber-reinforced disks (Spencer), properties of small and finite amplitude waves (Parker), impact response of unidirectionally reinforced beams and plates under the assumptions of fiber inextensibility and rigid-plastic behavior (Spencer), and a static continuum theory of materials containing a network of inextensible fibers (Pipkin).

The contributions are based on the authors' original, published research, and can be fully appreciated by readers who have an adequate knowledge of continuum mechanics. The book is highly recommended to all serious researchers in solid and structural mechanics.

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Abstracts from Soviet Aerospace Literature

Abstracts will not appear this month. For previous topics see the following 1987 issues: January, *Aerodynamic Research and Development*; February, *Structural Mechanics*, March, *Fluid Dynamics*; and April, *Propulsion.*