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book reviews

Behavior of Materials

Stress-Strain Behavior of Elastic Materials. By O. H. Varga. Interscience Publishers, Division of John Wiley & Sons, New York, N. Y., 1966. X and 190 pp. $11.00.

REVIEWED BY E. H. DILL[1]

IN ORDER to appreciate this monograph, one must view it in the proper context: It is Volume 15 of a series called *Polymer Reviews*. The authors in the series are expected to review a current topic in light of their own opinions and accomplishments.

The main contribution in this volume is the comparison of the observed behavior with the predicted behavior for some simple fundamental deformations and some particular stress-strain laws. Special consideration is given to the Mooney form of the stored energy function and to a linear relation between principal stresses and principal extensions. The first half of the book contains a review of some aspects of the theory of elasticity presented in an elementary way.

This monograph is entertaining light reading for the theorist and may be a useful reference work for the experimentalist concerned with measurements of mechanical properties of nonlinearly elastic materials.

Non-Newtonian Fluids

Viscometric Flows of Non-Newtonian Fluids. By B. D. Coleman, H. Markovitz, and W. Noll. Springer-Verlag, Inc., New York, N. Y., 1966. x and 130 pp. $5.50.

REVIEWED BY BRUCE CASWELL[2]

THIS thin volume presents for the beginner the steady flows of viscometry according to the theory of simple fluids first proposed by Noll in 1958, and subsequently elaborated upon in collaboration with Coleman. By treating only these uncomplicated motions, the mathematical prerequisites necessary for the study of the original papers have been much reduced. In viscometric flow the stress tensor is determined by three functions which are material properties. Careful analysis of each flow is presented, along with a discussion of the techniques of measurement of the material functions.

Some experimental results are displayed including the only reliable measurements yet published of all three material functions for a single sample.

A continuum theory cannot, of course, predict the form of the material functions. It is a pity that no attention is given to those brave, if imperfect, attempts at predicting the forms of these functions from structural-molecular considerations. While in the past the subject has suffered because of an overemphasis on special theories, the beginner should bear in mind that the success of the continuum theory in viscometry is due mainly to the simplicity of the flows. The difficulties of continuum mechanics become apparent only when one proceeds to motions beyond the scope of this book.

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Plasticity

A Theory of Plasticity for Ideal Frictionless Materials. By Bent Hansen. Teknisk Forlag, Copenhagen, Denmark, 1965. 471 pp.

REVIEWED BY A. C. PALMER[3]

THIS BOOK is more restricted in content than its title suggests. It describes a general solution method for plane deformation problems in an incompressible elastic perfectly plastic frictionless material, the ideal material of classical plasticity. Most of the book is devoted to analytic and numerical methods for finding slip line field solutions. Limit analysis techniques are used to bound collapse loads, though here much of the method's power is lost through an arbitary restriction of the stress and velocity fields used to those close to exact solution fields. The examples are taken from soil mechanics. A brief final chapter suggests a program for future work, and underlines the difficulties in extending the method to real frictional soils.

The text seems curiously isolated from other work, and includes few references. Since the elements of slip line analysis have been more clearly described by other authors, this reviewer wished that more space had been given to the author's own development of the theory. Among the topics mentioned are a rational design method for systems where soil and an external structure interact, and a technique for locating upper bounds closely similar to the equilibrium method in concrete slab analysis. Although the book is oriented toward soil mechanics, much of it will interest workers in other areas of plasticity.

Heat Transfer

Convective Heat and Mass Transfer. By W. M. Kays. McGraw-Hill Book Company, Inc., New York, N. Y., 1966. Bound, xxvi and 387 pp. $13.75.

REVIEWED BY J. H. WHITELAW[4]

THE subject matter in this book is restricted to convective heat and mass transfer, as the title suggests, and the author is therefore able to deal with a wider variety of boundary conditions than are to be found in the several books on heat transfer which deal with conduction and radiation in addition to convection. The author derives the differential and integral equations without hidden assumptions, and examines internal and external laminar and turbulent flows with and without heat transfer in a clear and logical manner. The three chapters on mass transfer owe much to the formulations of D. B. Spalding and represent an excellent introduction to the subject.

As a reference book for the engineer, the book suffers from an inadequate index and from the presentation of property values mainly in graphical form. It does, however, contain recent references in the convection field, although these are by no means comprehensive. The system of units is British which will render the book more acceptable to the majority of practicing engineers in the United Kingdom and the United States but less acceptable to the growing minority who would like to see the spread of the S.I. system of units.

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