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Book Reviews

Thin Plates and Shells—Theory, Analysis and Applications

Eduard Ventsel and Theodor Krauthammer, Marcel Dekker, Inc., New York, 2001, 666 pp., $175.00

This is a well-written and organized text for use in introductory course or courses in thin-plate and thin-shell theory. The amount of material contained can easily be used for one- or two-semester courses on the subject. The instructor who adopts this book as a text can easily omit and/or add material to accomplish his educational objectives.

Part I, titled Thin Plates, presents in a clear and consistent manner the governing equations for isotropic thin plates, when acted upon by transverse and in-plane loads. Applications include rectangular plates, circular plates, and other shapes. Moreover, various methods of solution are presented and the topics of free vibrations and buckling of plates are treated in two chapters. The coverage of laminated, stiffened, and sandwich plates is very limited, but it serves the purpose of introducing the student to the analyses of these constructions.

The approach is similar in Part II, titled Thin Shells. Definitions of shells and classification of shells are presented in a clear manner. Field equations and boundary conditions, whenever applicable, are derived for both membrane and bending theories of thin shells. Applications include cylindrical, conical, spherical, and toroidal configurations. Shell theory is approximate in nature, and some approximate theories are presented in the text. In this section also, the topics of free vibrations and buckling of specific thin-shell geometries are treated in two chapters. Topics of imperfection sensitivity and of analysis of nonisotropic constructions are presented only as an initial exposure to the subject. What is missing in the treatment is the effect of in-plane boundary conditions for axially loaded thin cylindrical shells and the effect of stiffener eccentricity.

In closing, this reviewer feels that this book is an excellent addition to the literature, although he also observes an Eastern European bias, especially in referencing. Some important Western works are neither referenced nor discussed. An introduction to thermal stresses in thin plates and shells is included. No book can be all things to all people, but this one, in spite of some minor flaws, comes close.

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Unified Plasticity for Engineering Applications

Sol R. Bodner, Kluwer Academic Publishing, New York, 2001, 128 pp., $75.00

This book is a monograph that describes in a systematic way particular constitutive relations for visco-plastic materials. Those constitutive relations were introduced in the late 1960s and early 1970s by Bodner and Partom. The three-dimensional formulation, called the B–P model of visco-plasticity, is based on a unified approach where the inherent dependence of inelastic deformation on strain rate and temperature can be taken into account in different modes of time-dependent, deformationlike, rate-dependent plasticity, creep, and stress relaxation. In addition, the strain rate and temperature history effects can be included in this theory of visco-plasticity via internal state variables. Such an approach to the rate- and temperature-dependent plastic behavior of materials is limited, however, to the small strain case where the elastic, totally reversible, and inelastic, nonreversible, strain rates are additive. It is also assumed in this model that the elastic and nonelastic strain rates are generally nonzero at all stages of loading and unloading, and the concept of the yield limit is abandoned in this unified modeling. The author claims that, when sufficiently accurate measurements are made, all materials are seen to behave in this manner.

The book contains three main parts: formulation of the unified constitutive theory, specific applications, and commentaries. In the last part of the book some examples are given as to how to interpret the variety of material constants introduced in the model for different cases. Their values are also given for some industrial metals and alloys. Finally, the book contains about 200 references. Many particular engineering problems, such as variable rate of hardening during cycling loading at different temperatures, creep of metals at different temperatures, continuum damage modeling via a state variable approach, structural mechanics, and, finally, plastic wave propagation, are discussed in detail. Those examples clearly demonstrate the applicability of the B–P unified theory, including its flexibility, to a variety of engineering problems. The theory may be especially useful at high temperatures and also at high strain rates. The B–P model has already been introduced in a number of finite element codes, for example EPIC-2 and ABAQUS.

Because this monograph takes into account many publications on B–P constitutive relations and its applications that have appeared in a variety of journals and reports and in many conference proceedings over the past 30 years, it can be very useful as a fundamental source of information on advanced unified visco-plasticity theory for academia, engineers, and graduate students.

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