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book reviews

The Linear Theory of Thermoelasticity. By Ian N. Sneddon. Springer-Verlag, New York. 1974. Pages 197. Cost $9.60.

REVIEWED BY A. L. FLORENCE[1]

The monograph consists of four chapters and an Appendix. Chapter 1 gives a brief account of the derivation of the basic equations of the linear theory of thermoelasticity. Chapter 2 treats thermoelastic harmonic wave propagation. Chapter 3 presents the solutions of dynamic boundary-value and initial-value problems. Chapter 4 treats static thermoelastic problems. The Appendix collects integral transform results required.

The theory is that established by Biot in 1956 and includes irreversible thermodynamics for the interaction of strain and heat conduction. In the monograph, the temperature variation considered allows the use of constant mechanical and thermal properties and an isotropic solid is considered to simplify the presentation.

The monograph is valuable not only to those interested in thermoelasticity but to those who encounter problems amenable to solution by transform techniques. The mathematical treatment is lucid and presented as a natural extension of the familiar classical linear elasticity. The reader must, however, be familiar with basic thermodynamics to understand the physics of the basic equations. Among the innumerable important topics covered are as follows:

1 Plane harmonic waves (uncoupled elastic and thermal waves, general quasi-elastic and quasi-thermal waves, Rayleigh waves, and cylindrical waves).

2 The semi-infinite rod with basic oscillatory and transient end conditions.

3 The infinite solid with various types of heat sources.

4 Basic static problems of a half space, thick plate, and penny-shaped crack.

Composite Materials and Their Use in Structures. By J. R. Vinson and T. W. Chou. Halsted Press. 1975. Pages vii–438. Cost $47.50.

REVIEWED BY J. J. McCOY[2]

The text by Professors Vinson and Chou is really two small texts combined under one cover. Chapters 1, 2, 3, and 8 treat the "materials" aspects of composites whereas Chapters 4, 5, 6, and 7 deal with the analysis of structural members that are formed from composites. The number of pages devoted to each of the subtexts (some 200 pages) are also the same. Since this reviewer found the two subtexts to differ in presentation as much as in content it is natural to review each separately.

The chapters dealing with the analysis of structural members that are formed from composites would be the more familiar to the readers of the JOURNAL OF APPLIED MECHANICS dealing as it does with the theories of plates and (cylindrical) shells. The presentation will be familiar to those educated in the Timoshenko approach to mechanics, being distinguished from a number of other texts only in its emphasis of the consequencies of material anisotropy, which plays such a large role in fiber-reinforced composites. A rather detailed introduction is provided to the more recent literature dealing with the incorporation of both anisotropy and shear deformation into plate and shell theory. The level would appear to make much of the material accessible to seniors or graduate students who have some familiarity with the fundamentals of elasticity theory.

The chapters dealing with composites as a material are, on the whole, a good deal more descriptive than are those just discussed. This is due in a large part to the much broader range of topics that are covered. An introductory chapter considers the ideas and terminology of the structure of solids on a molecular scale. The three subsequent chapters consider fiber-reinforced composites, dispersion strengthened and directionally solidified eutectic composites, and the strength and fracture of composite materials. The chapter on fiber-reinforced composites is wholly descriptive. Fabrication processes for the various types of composites are discussed as well as the physical and chemical properties of the component phases. Dispersion-strengthened and directionally solidified eutectic composites are paid much less attention than are the fibrous composites although the bibliography for this chapter is quite extensive. It is only in the chapter dealing with the strength and fracture of composites that any quantitative predictive models are discussed. These discussions are on an elementary level and should be readily understood by advanced level undergraduates.

This reviewer believes the book by Professors Vinson and Chou could well serve as a text for an advanced level course in a sequence for students with a specialized interest in structural engineering.

Progress in Experimental Mechanics. Durelli Anniversary Volume. Edited by V. J. Parks. The Catholic University of America, Washington, D. C. 1975. xxvii—279 Pages. Cost $20.

REVIEWED BY C. E. TAYLOR[3]

A fitting tribute to a remarkable scientist, educator, and person. The volume, which was edited by V. J. Parks is a collection of invited contributions from Dr. Durelli's former associates. A list of Durelli's engineering publications is impressive because of the number (225 through Feb. 1975) and the variety of experimental methods involved. The several written discussions included indicates that he also reads other people's papers. Durelli's versatility as a scientist is well known, but the short biography included in the volume reveals some lesser known attributes and accomplishments of the man. For example, he has received Doctors' degrees in Engineering and in Social Sciences, and wrote many articles, pamphlets, and four books on problems in the social and political sciences in Spanish and French.

The consistent high quality of the papers and the eminence of the authors, most of whom were students of Dr. Durelli, are evidence of his success as an educator. There is an understandable variation in the length, style, and objectives of the individual papers. Some are original contributions describing significant improvements in experimental techniques. Other papers are review articles summarizing areas of experimental mechanics, and some applications of known techniques to solve new problems. In spite of the difference, each paper makes its own contribution.

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