Nonlinear Deformation Waves. Edited by U. Nigul and J. Engelbrecht. Springer-Verlag, New York, 1983. 452 Pages. Price $42.50.

REVIEWED BY T. W. WRIGHT[3]

This volume contains the papers presented at an IUTAM Symposium held at Tallinn, Estonia, in August 1982. There are 45 papers in the volume, slightly more than half from Eastern European countries, principally Russia, the others from the rest of the world with 16 different countries represented in all. The book is divided into five parts: Part 1, Analytical Methods and Evolution Equations (13 papers); Part 2, Waves in Hereditary and Plastic Media (10 papers); Part 3, Inverse Problems (6 papers); Part 4, Nonlinear Acoustics (5 papers); and Part 5, Combined Fields and Applications (11 papers).

As might be expected in a symposium of this kind, the quality of the papers is rather uneven. Many of the best ones are surveys of the author's and related work, and as such they contain a number of references, which may serve as a useful, general guide to a somewhat specialized and often scattered literature. The papers by Taniuti, Crighton, Blackstock, and Grimshaw all fall in this category. Taniuti reviews the reductive perturbation method as applied to systems of equations with dispersion or dissipation for which the basic models are the Korteweg-de Vries or Burgers equations. Crighton summaries the ways in which a modified Burgers equation can be used to model the propagation of shock waves over large distances, including geometric and viscoelastic effects and the ways in which the shock structure can break down. Matched asymptotic expansions play a strong role here. Blackstock describes many interesting phenomena in the interaction of colinear sound beams, with application such as the parametric transmitting array, self-demodulation, and sound suppression. Grimshaw uses model equations to analyze the propagation of long waves in stratified shear flows, which has important applications in geophysical fluids. Solitary waves are especially emphasized. There are interesting research papers throughout the book which touch on topics as diverse as solitions in active media (Ostrovsky), gas or liquid filled tubes (Buggisch, and Mainardi and Buggisch), edge waves along a sloping beach (Akylas), localized deformation in metals and polymers (Barenblatt), nonlinear elastic surface waves (Parker and Talbot), and the propagation of domain walls in ferroelectric crystals (Maugin and Pouget), to single out just a few which appealed to this reviewer.

The many other papers cover a wide range of applications that arise in very disparate physical situations, but the preceding comments have already introduced most of the principal themes that recur throughout the book. These are model equations, solitary waves, and various asymptotic methods to describe evolutionary changes in systems where the nonlinearity is of relatively low order. The emphasis is decidedly analytical rather than experimental or computational although some work of the latter types is reported. It was disappointing to find only one example of similarity techniques and no example at all of the modifed simple wave analysis as developed by Varley and coworkers, since these two methods do find applications in problems with stronger nonlinearities.

Although the volume will appeal mostly to specialists, it serves a useful purpose in summarizing some of the principal methods in vogue today for analyzing problems of nonlinear wave propagation, and in showing the wide range of physical problems to which these methods may be applied.

[3]Ballistic Research Laboratory, Aberdeen Proving Ground, Md. 21005. Mem. ASME.

Finite Elasticity. Edited by D. E. Carlson and R. T. Shield. Martinus Nijhoff, The Netherlands, 1982. 460 Pages. Price $79.00.

REVIEWED BY M. M. CARROLL[4]

The IUTAM Symposium on Finite Elasticity was held at Lehigh University, Bethlehem, Pa., August 10–15, 1980. This Proceedings volume contains a Foreword by R. S. Rivlin, who chaired the international scientific committee, as well as the texts of the five general lectures and 24 invited papers. The committee is to be congratulated on constructing an excellent program, which embraces mathematical foundations, solution techniques, experimental investigations, and emphasizes new and exciting research directions in this important field.

The lectures and papers present excellent summaries of a wide variety of special topics, with useful references to earlier work. This volume should be required reading for workers in nonlinear elasticity. It is also very worthwhile reading for workers in other areas of nonlinear continuum mechanics. The complete list of topics and authors follow.

General Lectures

J. M. Ball, "Existence of Solutions in Finite Elasticity."

W. T. Koiter, "Elastic Stability, Buckling and Post-Buckling Behavior."

G. J. Lake and A. G. Thomas, "Mechanics of Fracture of Rubber-Like Materials."

P. M. Naghdi, "Finite Deformation of Elastic Rods and Shells."

R. S. Rivlin, "Some Thoughts on Material Stability."

Invited Papers

P. G. Ciarlet, "Two-Dimensional Approximations of Three-Dimensional Models in Nonlinear Plate Theory."

P. K. Currie and M. Hayes, "On Nonuniversal Finite Elastic Deformations."

G. Duvaut, "Nonlinear Boundary Value Problem in Thermoelasticity.

J. L. Ericksen, "Changes in Symmetry in Elastic Crystals."

G. Grioli, "A Variational Approach to Finite Elasticity."

M. E. Gurtin, "On Uniqueness in Finite Elasticity."

A. G. Herrmann, "On Physical and Material Conservation Laws."

J. M. Hill, "Finite Deformation of Thick-Walled Inner Tubes and Tyres Under Inflation and Rotation."

J. W. Hutchinson and K. W. Neale, "Finite Strain J_2 Deformation Theory."

F. John, "Instability of Finite Amplitude Elastic Waves."

J. K. Knowles, "Localized Shear Near the Tip of a Crack in Finite Elastostatics."

I. Müller, "Stress-Strain-Temperature Curves in Pseudoelastic Bodies."

J. T. Oden, "Penalty Methods for Constrained Problems in Nonlinear Elasticity."

R. W. Ogden and D. M. Haughton, "Deformation and Vibration of Rotating Elastic Cylinders."

[4]Professor, Department of Mechanical Engineering, University of California, Berkeley, California 94720. Mem. ASME.