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book reviews

Mechanik der Polymer Werkstoffe. By A. Mälmeisters, V. Tamužs, and G. Teters. Akademie-Verlag, 108 Berlin, Leipziger Strasse 3-4, Germany. 1977. Pages 597. Price DM 120.

REVIEWED BY J. D. ACHENBACH[1]

The title of this book does not accurately describe its content. There is very little in it which deals with the actual mechanics of polymeric materials. Rather, it is an extensive survey of continuum mechanics and structural mechanics, with an emphasis on linear and nonlinear viscoelasticity, and with some applications to polymers. The book starts with a general introduction which discusses the philosophy and the methods of solid mechanics. It then proceeds with a chapter on the states of stress and deformation, which is followed by a lengthy chapter on elastic stress—strain relations, including a discussion of reinforced solids. Next, there is a chapter on viscoelastic materials, followed by one on plasticity, and a chapter on failure theories. The next to last chapter is a discussion of beam, plate, and shell theories, and the final chapter deals with stability of structural elements. The treatment is comprehensive, which makes the book suitable for use as a reference volume. An interesting aspect is that the lengthy list of references is principally based on papers published in the Soviet Union. Of the 366 referenced papers some 315 are in Russian. Thus the book may draw attention to much work which is perhaps largely unknown outside the Soviet Union. This book contains a wealth of useful information, and it is recommended as a handbook type-of-reference volume.

Point Mapping Stability. By J. Bernussou. Pergamon Press, Ltd., Headington Hill Hall, Oxford OX3 OBW, England, and Fairview Park, Elmsford, N.Y. 10523. 1977. Pages xi-103. Price $12.50.

REVIEWED BY T. K. CAUGHEY[2]

This monograph brings together the efforts of a number of workers, at the Centre National de la Recherche Scientifique, Toulouse, who, over the past decade have worked on the problem of point mapping stability. Nonlinear difference equations (or point mappings) arise in many fields of science and technology, both naturally, as in sampled data systems, population dynamics and genetics, and as a result of the application of numerical methods to nonlinear differential equations. As in the case of nonlinear differential equations, stability theory plays a central role in the theory of nonlinear difference equations, and is the theme of this monograph.

The monograph is divided into five chapters. The first two chapters deal with the theory of nonlinear difference equations with particular emphasis on the Lyapunov critical cases. The third and fourth chapters are devoted to applications of associated point mappings to the study of nonlinear differential equations with period coefficients, and in particular to deal with the problem of parametric resonance. The fifth and last chapter deals with numerical tools and practical features, several examples are included in this section.

This monograph should prove useful to the specialist and nonspecialist alike. The specialist will find it most valuable to have many important results, usually scattered throughout the literature, in one monograph. To the nonspecialist it should serve as a very good introduction to a new and challenging branch of nonlinear analysis.

Navier Stokes Equations: Theory and Numerical Analysis. By Roger Temam. North-Holland Publishing Company, P.O. Box 211, Amsterdam, The Netherlands, and 52 Vanderbilt Avenue, New York 10017. 1977. Pages xvi-454. Price $45.

REVIEWED BY A. CHORIN[3]

It is an unfortunate fact that the mathematicians who prove theorems about the Navier-Stokes equations, the numerical analysts who try to solve them, and the engineers who try to use these equations and their solutions, usually inhabit different worlds and know nothing of each other's work. This is unfortunate because they have a lot to say to each other. Physical facts are often a guide to what can be proved; existence and uniqueness theorems often use inequalities whose discrete analogs provide convergence theorems for approximate methods; such theorems are often a good guide to what should be done in practical computation.

Professor Temam's book aims at filling a part of this multiple chasm. He offers a unified treatment of existence, uniqueness, and convergence theorems for the Navier-Stokes equations and for some of their discrete approximations, using the functional analytic techniques so brilliantly developed and ably advocated in France. Professor Temam is an outstanding contributor to this field, and the diligent reader of his book can learn very much indeed. For the mathematician, this book provides a wonderful training ground in functional analysis, Sobolev spaces, compactness arguments, etc. The theoretical numerical analysts can learn from this book how to construct convergence theorems. Interesting practical information is contained in many of the theorems; for example, the theory of the projection method provides the path to the correct formulation of boundary conditions in practical computation.

From the point of view of the nonmathematician, however, the book has some shortcomings: The formal mathematical style is a bit forbidding; a little more heuristic motivation and explanation would have helped a lot. The book is long (500 pages), with uninformative chapter and section headings and no index. The bibliography is sketchy, and so is the introductory outline. The gold which the book contains may be a little hard to find.

Trends in Applications of Pure Mathematics to Mechanics. Edited by G. Fichera. 1976. Fearon-Pitman Publishing, 6 Davis Dr., Belmont, Calif. A member of Pitman Publishing, Ltd., 39 Parker Street, London W2C 5PB, England. Pages 512. Price $35.

REVIEWED BY R. J. KNOPS[4]

Engineering theories are becoming more sophisticated as nonlinearity and other effects are increasingly taken into account. Because of this, greater knowledge is required of recent advances in mathe-

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