A. C. Pipkin, "Boundary Integral Equations for Inextensible Materials."

K. N. Sawyers, "Stability of a Thick Neo-Hookean Plate."

R. T. Shield, "Finite Extension of Torsion of Thin Elastic Strips."

R. Skalak, "Growth as a Finite Displacement Field."

A. J. M. Spencer, "Stress Concentration Layers in Finite Deformation of Fiber-Reinforced Elastic Materials."

E. Stein, "Incremental Methods in Finite Elasticity, Especially for Rods."

T. Valent, "Local Theorems of Existence and Uniqueness in Finite Elastostatics."

T. W. Wright, "Nonlinear Waves in Rods."

L. J. Zapas, "The Strain-Energy Function for Rubber-Like Materials."

Handbook of Applied Mathematics: Selected Results and Methods, Second Edition. Edited by Carl E. Pearson. Van Nostrand Reinhold, New York, 1983. 1328 Pages. Price $67.50.

REVIEWED BY L. B. FREUND[5]

This volume contains 21 chapters on various topics in applied mathematics. The chapters have been written by 20 individuals, each of whom has been involved with the applications of mathematics, mostly in the physical sciences and engineering. The following topics are discussed in one or more chapters: basic analysis, vectors, tensors, complex variables, ordinary differential equations, partial differential equations, special functions, integral equations, transform methods, asymptotic methods, perturbation methods, linear algebra, functional approximation, numerical analysis, optimization techniques, probability, and statistics. Also included are chapters on several particular areas of application, namely, oscillations, wave propagation, and formulation of mathematical models.

The volume is not a handbook in the usual sense, that is, it is not a collection of tables and formulas. Instead, each chapter represents the author's summary description of the chapter topic, with emphasis on the ideas and techniques of potential value in problem solving. Motivation is provided from the applied sciences for most of the topics discussed and the presentation is generally descriptive, rather than formal. Based on a close look at several of the chapters in areas most familiar to me, the treatment is quite complete. The chapters have been prepared independently, without cross-referencing, so that some topics are covered more than once, usually from different points of view. The volume does include an extensive index of 32 pages, so that the place in which any particular topic is considered can easily be determined. For example, the Wiener-Hopf method can be found in the chapter on transform methods, variational methods are discussed mainly in the chapters on ordinary differential equations and on optimization, and the finite element method is briefly introduced in the chapter on partial differential equations of second and higher order.

The coverage appears to be quite complete within the branch of mathematics commonly termed analysis. The rationale for including two chapters on specific applications, namely, wave propagation and oscillations (nonlinear vibrations), is not clear. It would be difficult to argue that the treatment of any paticular topic in the Handbook would be preferable to that in one of those favorite text books most people have on their bookshelves. However, this volume has the advantage of providing a quick reference to a wide range of topics. The Handbook is a reference work of significant potential value to anyone concerned with application of analytical methods in applied mechanics.

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Statistical Mechanics of Elasticity. By J. H. Weiner. Wiley, New York, 1983. 439 Pages. Price $49.50.

REVIEWED BY F. MILSTEIN[6]

Professor Weiner is to be congratulated for a timely, scholarly, and well-written book which makes a significant contribution to the pedagogic literature on atomic-based descriptions of the elastic behavior of both crystalline and polymeric solids. The content and style of the book reflect its origins; i.e., it is an outgrowth of a course, for graduate students in solid mechanics, "intended to provide an alternative to the usual course in statistical mechanics in which the major emphasis of application is to gases and liquids and to electronic and magnetic phenomena." Although the book is written mainly for the solid mechanics community (e.g., it employs advanced mathematics of continuum solid mechanics after but a brief chapter on the fundamentals of solid mechanics and classical thermodynamics), it also contains a wealth of material (including "standard" topics, recent research results, and an extensive list of references) that will be of immense value and interest to researchers and advanced graduate students in the fields of materials science and solid state physics (as well as solid mechanics).[7]

The book is divided into two parts; the first (which is about twice the length of the second), develops the principles of classical statistical mechanics and then presents a wide variety of applications of these principles in chapters on crystal elasticity, rubber elasticity, and rate theory in solids. The development of statistical mechanics follows "the approach that relates the quantities calculated by the methods of equilibrium statistical mechanics to time averages of observed properties." The author states that this treatment is heuristic; workers concerned with the foundations of statistical mechanics will no doubt find it so, although materials scientists and others who are mainly concerned with applications might find the development leaning toward rigor and formalism. The value of the book to researchers in mechanics and materials is enhanced by the authors choice of applications (which comprise over one-third of the book, and which, in many cases, are of current interest in the literature). The presentation on crystal elasticity contains discussions of the atomistic concept of stress, elastic constants and their temperature dependence, the Cauchy relations, and lattice dynamics. Two chapters on rubber elasticity include atomic structure, one and three-dimensional polymer models, the network theory of rubber elasticity, partition functions for rigid and flexible polymer models, stress and strain ensembles, and phantom networks. Impurity atom diffusion,

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[7]Footnotes are effectively used throughout to provide important details, including selected references to original papers or to sources of additional information, and interesting historical notes; e.g., (p. 388) Einstein (1911) computed atomic frequencies from specific heats and from elastic properties and called "the agreement (~ 20 percent) between these two frequencies 'wahrhaft überraschend' [truly surprising]."