BOOK REVIEWS

An Introduction to Applied Anisotropic Elasticity. By R. F. S. Hearmon. 136 pp. Oxford U. Press, New York, 1961. $5.60. *Reviewed by Alexei A. Maradudin, Westinghouse Research Laboratories.*

MODERN elasticity theory can be said to date from the work of Cauchy and of Green in the second quarter of the last century. The equations of elasticity obtained by both Green and Cauchy contain twenty-one constants in the general anisotropic case (although in Cauchy's theory only fifteen are what we now call elastic constants). By contrast, in the special case of elastic isotropy, only two constants are required to describe the state of stress and strain in an elastic body. It has been known for a long time, certainly from the time of Voigt's researches in the 1880's, that few solids occurring in nature are elastically isotropic. Yet until now there has been no book written in the English language devoted exclusively to anisotropic elasticity theory and its applications, and this deficiency is in large measure the reflection of both the mathematical and computational difficulties which attend the solution of the equations of a multiconstant theory of elasticity. The book under review thus satisfies a definite need for workers in the field. It should prove to be very useful to students first learning about anisotropic elasticity theory, and to research workers interested in having a summary of the results obtained to date and the methods used. After two admirably written chapters of introductory material on the equations of equilibrium, the generalized Hooke's law and the physical significance of the quantities which enter into it, as well as crystal symmetry and the relations among elastic constants it imposes; methods of measuring elastic constants are described together with a discussion of their values in polycrystalline materials. The remainder and major part of the book is devoted to the application of the general theory to a wide variety of different problems. A partial list of the topics covered includes torsion of bars of various cross sections, thermal stresses, wave propagation, and the theory of anisotropic plates. Among other sources, recent Russian work is drawn on for illustrative examples in these chapters. The material is clearly presented, if concisely, and comparison between theoretical and experimental results is made wherever possible. A useful bibliography is appended.

The word "Introduction" in the title of this book may be slightly misleading. It does not imply "simple". Nor is the book a self-contained treatise on elasticity theory; some knowledge of at least isotropic elasticity theory on the part of the reader is assumed.

We have spoken above of the computational difficulties which are often encountered in the solution of problems of anisotropic elasticity theory. The present book may be regarded as a summary of what has been achieved to date by hand computation alone. The results are sufficiently impressive that one can hope that one of the consequences of the publication of this book will be the stimulation of interest in the use of high speed computers in subsequent work in anisotropic elasticity.

Electrodynamics of Continuous Media. Vol. 8 of Course of Theoretical Physics. By L. D. Landau and E. M. Lifshitz. Transl. from Russian by J. B. Sykes and J. S. Bell. 417 pp. Pergamon Press Ltd., Oxford, 1960. Distributed in US by Addison-Wesley Publishing Co., Inc., Reading, Mass. $12.50. *Reviewed by E. H. Dill, University of Washington.*

THIS latest volume in an outstanding series deals with the macroscopic electric and magnetic fields in matter and with the macroscopic electric and magnetic properties of matter. In the classical manner, matter is divided into two classes, conductors and dielectrics. This leads to the chapters: electrostatics of conductors, electrostatics of dielectrics, constant current, constant magnetic field, ferromagnetism, superconductivity, quasistatic electromagnetic field, magnetic fluid dynamics, the electromagnetic-wave equations, propagation of electromagnetic waves, electromagnetic waves in anisotropic media, passage of fast particles through matter, electromagnetic fluctuations, scattering of electromagnetic waves, and diffraction of x rays in crystals.

As in the other volumes, it is assumed that the reader is mature. A knowledge of vectors and cartesian tensors is assumed as well as familiarity with the earlier volumes of this series.

The macroscopic equations are obtained from the microscopic by taking averages over the elements of volume which are "physically infinitesimal". The boundary conditions between different media are determined from a consideration of the possible singularities of the field equations. Not only are the basic equations presented, but, in keeping with the physical nature of the presentation, solutions are given to certain problems which illuminate the physical manifestations. Additional applications are given as problems, usually with the solution given at the end of each chapter. The book could be used as a graduate text.

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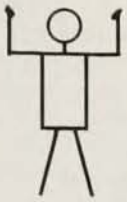

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physicists prefer to explain the fundamental relations as derivable from a few basic experiments. The present volume is neither an axiomatic presentation nor are the explanations based directly upon experimental evidence. A median is achieved; the authors give the physical basis for each phenomenon together with a complete mathematical formulation.

Relativity: The General Theory. By J. L. Synge. 505 pp. (North-Holland, Amsterdam) Interscience Publishers, Inc., New York, 1960. $16.50. *Reviewed by Jacques Romain, Convair/Fort Worth, Division of General Dynamics.*

A NEW book on relativity by Professor Synge is an event indeed. Those who have read his former books (*Relativity: The Special Theory* and *The Relativistic Gas*) know that his books offer deep critical discussions of the subject.

The main feature of this book is its completely geometrical point of view. The reader is given direct insight into four-dimensional Riemannian space-time and shown how to use simple space-time diagrams instead of the usual Newtonian description. Such an approach seems ideally suited to handle general relativity in a profound and creative way, especially in view of the present attempts towards a unified theory.

The book begins with a mathematical exposition of essential tensor formulas, and a full study of the main mathematical tool brought into use by the author, the "world-function", which is essentially the square of the geodesic separation of two events, and which permits developments in power series within the frame of tensor calculus. After a fundamental chapter on chronometry in Riemannian space-time, the material continuum and its energy tensor are introduced. The second half of the book deals with properties of Einstein fields and fields with spherical symmetry, integral conservation laws, the equations of motion, some special universes, gravitational waves, electromagnetics, and geometrical optics. Since the author goes back to first (geometrical) principles and rebuilds every topic in his own way, the book is not a general survey of the field. It is rather an up-to-date selection of outstanding topics worked out with the new method. Although the geometrical treatment never obscures the physical meaning, the physical exposition of the argument that leads to the well-known equations of general relativity is not included. The reader would do well to review the main features of general relativity before undertaking a study of this book. Then he will be prepared to learn that several things he thinks he understands do not make any sense at all.

The style of thinking and the spirited writing of the book are typified by the following quotation from the preface: "If I break my neck by falling off a cliff, my death is not to be blamed on the force of gravity (what does not exist is necessarily guiltless), but on the fact that I did not maintain the first curvature of my world-line, exchanging its security for a dangerous geodesic."