

BOOK REVIEWS

sity, the *mass-centered* diffusion flux must be considered, which implies that the appropriate concentration variable is the *mass fraction*. It is often necessary to use the mass-centered system for another reason also: When chemical reaction occurs, moles are not conserved, whereas mass is; the mass fraction also recommends itself when the molecular weight of the diffusing substance is uncertain, as in the case of a hydrocarbon fuel diffusing toward a flame. The reviewer did not find in the book any statement of the above views (which may be wrong) or of any alternative recommendations for dealing with problems of this kind, which arise in almost every practical application of mass-transfer theory.

It would, however, be entirely unfitting to close this review on a critical note. The reviewer has therefore saved until the end an expression of his profound admiration for a work which is scholarly, lucid, and elegant. The authors have taken almost unprecedented pains to aid the student's labors; careful definitions, helpful notation, lively examples, and handsome printing make this work one of which the authors, and the publishing house, can take a well-justified pride. Students, teachers, and industrial scientists will be grateful to them for a long time to come.

Fluid Mechanics

Lectures on Fluid Mechanics. Lectures in Applied Mathematics, Vol. II. By Sydney Goldstein with J. M. Burgers. Interscience Publishers, Inc., New York, 1960. Cloth, xvi and 309 pp. \$5.

REVIEWED BY JOSEPH H. CLARKE⁵

THIS volume contains the written version of a series of lectures which were given by Sidney Goldstein at Boulder, Colo., in 1957, and were designed to acquaint mature mathematicians with fluid mechanics. An arresting aspect is that Goldstein was to deal with the entire subject in only twelve lectures. Thus he has had to pass over all but what he regards as the essential ideas, achievements, and problems. Since he clearly accepted his assignment with some gravity, it is interesting to peruse what one of the elder statesmen of fluid mechanics saw fit to present in his account. The result is not a survey because the coverage is incomplete and the choice of material is, to a considerable extent, arbitrary and personal; and, while very succinct, it is no mere cataloguing of topics. The result is a satisfying and thoughtful series of lectures set forth with a definite point of view not to be found in more formal treatises. At times the mellow, reflective, and trenchant remarks conjure a setting in which the reader shares Goldstein's hearthside over sherry. The volume will certainly reward readers with many different points of view.

The classification of the subject and hence the chapter headings are conventional, except for the early point at which electromagnetic effects are introduced. The volume contains two tours de force. One is a new careful formulation of the field equations of magnetohydrodynamics, regarded as the electrodynamics of a moving medium. Subjoined to this are two detailed problems of magnetohydrodynamics provided by J. M. Burgers. The second is on an asymptotic solution to the Navier-Stokes equation for flow past a flat plate. The book contains an interesting discussion of the Newtonian stress-strain rate relations from the point of view of molecular relaxation or lag phenomena, as well as other comments on the relationship between the field and molecular formulations. There is a short chapter on the related matters of mixtures and chemical kinetics. Some absorbing remarks are offered on the theoretical question of whether the classical Helmholtz-Kirchhoff free-streamline theory can be regarded as the correct, if unstable, limit of the steady viscous flow as the viscosity tends to zero. Other interesting observa-

⁵ Associate Professor, Division of Engineering, Brown University, Providence, R. I.

tions, not entirely looked for in such a development, are salted throughout the volume.

Thermal Stresses

Theory of Thermal Stresses. By Bruno A. Boley and Jerome H. Weiner. John Wiley & Sons, Inc., New York, London, 1960. xv and 586 pp. \$15.50.

REVIEWED BY W. PRAGER⁶

THE PUBLICATION of this comprehensive text on the theory of thermal stresses is particularly welcome at a time when the design requirements in rocket propulsion and nuclear power have greatly enhanced the importance and extended the scope of this field. By devoting about two fifths of the book to a careful treatment of the fundamentals of thermoelasticity (Part I) and heat conduction (Part II), the authors have achieved a nearly self-contained presentation of their subject. The rest of the book consists of two parts dealing with the analysis of thermal stresses in elastic (Part III) and inelastic (Part IV) systems. The unequal development of these subjects is strikingly illustrated by the fact that Part II, which is almost twice as long as Part IV, discusses a large number of applications regarding thermal stresses in elastic beams, rings, trusses, frames, disks, and plates, and thermoelastic stability. Part IV, on the other hand, is primarily concerned with the basic formulation of viscoelastic and elastic-plastic behavior in the presence of temperature changes, and only a few specific applications are treated.

In the writing of a work of this ambitious scope, decisions on emphasis cannot be avoided that are readily explained in terms of the authors' interests but may otherwise appear arbitrary. For example, throughout the book the elastic coefficients are treated as temperature-independent quantities, but no effort is made to justify this, whereas the effect of the mechanical coupling term in the equation of heat conduction is discussed at great length. On the whole, however, the authors have achieved a remarkable balance in the treatment of the fundamental aspects of the theory and its applications, and the book is bound to become a standard reference in the literature on this field.

Wave Propagation

Wave Propagation in a Random Medium. By L. A. Chernov. Translated by R. A. Silverman. McGraw-Hill Book Company, Inc., New York, N. Y., 1960. Cloth, 7 1/2 × 10 in., viii and 168 pp.

REVIEWED BY J. LYELL SANDERS, Jr.⁷

THE BOOK is divided into three parts, the ray theory, the wave theory, and applications to focusing systems. The author's treatment of his subject is lucid and concise. Not too much specialized mathematical equipment is required of the reader, but some familiarity with the technological problems in the field is helpful. The book serves both as an introduction to the subject and a summary of recent results of Russian work in the field. The translation is good.

The book begins with a discussion of the relevant statistical characteristics of the medium, in particular the correlation function of the refractive index. Following this is a treatment of the problems of scatter and fluctuations in transit time and intensity in so far as the ray approximation is adequate. The subject of scattering is developed further by use of the wave theory and the method of small perturbations in a following chapter. Fluctuations in amplitude are then treated by the wave theory using both the ordinary method of small perturbations and Rytov's method.

⁶ L. Herbert Ballou University Professor, Brown University, Providence, R. I.

⁷ Associate Professor of Structural Mechanics, Division of Engineering and Applied Physics, Harvard University, Cambridge, Mass.