a mathematically unsophisticated audience, and so mathematical arguments for the most part proceed formally or are kept on an intuitive level. On occasion, however, the unavoidable amount of imprecision which such an approach entails is compounded through carelessness. For example, the adjective "continuous" is used in a number of objectionable ways, not the least of which is the definition of a "continuous signal" as "any function of a continuous variable." In a somewhat different category is the incorrect assertion made in a footnote on p. 48 to the effect that a necessary condition for a differential equation to uniquely specify a system is that the system be nonanticipative.

Despite these critical comments, a reader armed with the appropriate mathematical caveats will find much of value in this book, which is likely to be successful as an introductory text on modern system theory.

Liquid Theory

Statistical Theory of Liquids. By I. Z. Fisher. Translated by T. M. Switz, with a supplement by S. A. Rice and P. Gray. University of Chicago Press, Chicago, Ill., 1964. xii and 335 pp. $12.50.

REVIEWED BY F. C. ANDREWS[2]

THE STATISTICAL mechanical theory of the liquid state is frustratingly difficult due to the cooperative effects caused by the molecules' interactions. Many interesting problems remain unsolved. Lately the subject has received increased attention, and the appearance of several new books, including this one, is a help to both the student and the serious research worker.

The 230-page translation of Professor Fisher's book, originally published in Russian in 1961, is a surprisingly easily read discussion of the equilibrium properties of simple one-component classical fluids. A summary of chapter titles outlines the coverage: the classical statistical integral, correlation functions, liquid structure, surface phenomena, stability and phase transitions, and numerical methods in liquid theory.

The 100-page supplement emphasizes the grand canonical ensemble, diagram and cluster-integral techniques, and a study of some of the recent integral equations.

For the reader with excellent background in statistical mechanics, this book is a good summary of equilibrium liquid theory and contains many interesting research ideas. Its inclusion of much recent Russian work is very useful. By way of complaint, it is a pity that the translator and supplement writers did not agree on choice of symbols.

Magnetohydrodynamics

Engineering Magnetohydrodynamics. By G. W. Sutton and A. Sherman. McGraw-Hill Book Company, Inc., New York, N. Y., 1965. Cloth, xix and 548 pp. $19.75.

REVIEWED BY IRA M. COHEN[3]

THIS BOOK is intended to provide not only an understanding of fundamentals but also a detailed discussion of applications to propulsion and power generation. The chapter on the motion of charged particles, the usual collision-free orbit theory, is well presented except for the section on adiabatic invariants (which are never properly defined). First-order constants of the motion such as energy are here confused with constants of the motion to all orders such as magnetic moment. The treatment of the statistical behavior of plasmas is marred only by a section on plasma probes in which it is stated and allegedly proved that Langmuir probe performance is independent of the value of the ratio of mean free path to Debye length (p. 101). Quite the contrary is true. The chapters on conduction and diffusion in ionized gases, quantum statistics and ionization phenomena, and electromagnetic waves and radiation in plasmas, which complete Part I, Basic Principles, provide an adequate, though often superficial, introduction to some deep problems of current interest in plasma physics. In Part II, Magnetohydrodynamic Flows, Sutton and Sherman first derive the MHD equations and then apply this formulation to shock waves, channel flows, and boundary layers. It is here and in Part III, Applications, where MHD propulsion and power generation are discussed in depth, that the real strength of this book lies. As a textbook this reviewer would recommend only the second half of the book—flows and applications—although the first half is certainly a more than adequate guide to the requisite fundamentals. However, for a text the price is unconscionable.

Plasma Physics

Plasma Physics. By J. L. Delcroix. John Wiley & Sons, Inc., New York, N. Y., 1965. xii and 266 pp. $7.75.

REVIEWED BY IRA M. COHEN[4]

THIS IS the translation of the first of two volumes based on a course in ionized gases given at Paris by Professor Delcroix. Since the French edition is dated 1963, references to the literature after 1961 in this rapidly developing science are the rare exception rather than the rule. However, the author has been largely successful in separating out the fundamentals, leaving the frontier subjects, which are most dependent on current research, for Volume II. As a text the level is from intermediate to advanced. For example, orbit theory is only briefly discussed with little more than a summary of principal results. However, the subject of elastic collisions receives treatment in depth. The second half of this book is concerned with kinetic theory of plasmas and related subjects. Here, as in the first half, considerable emphasis is placed on the assumptions behind and the limitations of each step in the analysis. An excellent chapter on microscopic equations first derives the Liouville equation, then the BBGKY heirarchy, explains the assumptions necessary for closure, and then discusses some of the consequences. Interparticle correlations and their contribution to plasma pressure are discussed in more depth than in any text known to this reviewer. Only the first chapter (which offers motivation for the study of plasma physics) and the last (on macroscopic properties of plasmas) even mention application to devices or physical situations. Nevertheless, the careful and sophisticated reader will benefit greatly from the new insights offered by this volume.

Boiling

Boiling Heat Transfer and Two-Phase Flow. By L. S. Tong. John Wiley & Sons, Inc., New York, N. Y., 1965. Cloth, 6 × 9 in., xiii and 242 pp. $14.

REVIEWED BY P. D. RICHARDSON[5]

THIS IS a handbook which contains an up-to-date (through 1964) compilation of correlations and design equations, arranged in an orderly manner, based on more than 400 cited references. It discusses the physics and the analysis of boiling phenomena to an extent no greater in general than found in current introductory heat transfer texts, except in connection with the description of two-phase flow. Even for the latter the author focuses on boiling

[2] Assistant Professor, Department of Chemistry, University of Wisconsin, Madison, Wis.

[3] Assistant Professor, Division of Engineering, Brown University, Providence, R. I.

[4] Assistant Professor, Division of Engineering, Brown University, Providence, R. I.

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

rather than the general case, so that in the chapter on instability of two-phase flow no reference is made, for example, to the (award-winning) 1963 paper of Ostrach and Koestel.

For a long time it has been a fact that our understanding of the physics involved in vapor formation and transport is insufficient even to permit satisfactory determination of empirical relationships based, say, on dimensional analysis. The recent advances in the cloud physics of bubbles in boiling have not been sufficient to change this fact. Meanwhile, advances in technological requirements (the cooling of nuclear reactors and rocket motors) have increased the need for careful review and further investigation. This book should be very useful to designers and to investigators who want a compact survey of the subject and an extensive introduction to its literature.

Elasticity

Stability and Oscillations of Elastic Systems. By Y. Panovko and I. I. Gubanova. Translated by Charles V. Larrick. Consultants Bureau Enterprises, Inc., New York, N. Y., 1965. Cloth, x and 291 pp. $17.50.

As Professor Flügge states in his foreword: "It is a book for mature readers, for those who have already been initiated into applied mechanics and who will read it for the pleasure of seeing many a surprising detail that is not found in books elsewhere. The authors have collected the unusual, the unexpected, the little, fascinating things that lie off the beaten path, and they have seasoned their presentation with historic notes, showing how even the leaders in the field have erred when a new situation called for an unconventional idea."—*Ed.*

Thermodynamics

Principles of General Thermodynamics. By G. N. Hatsopoulos and J. H. Keenan. John Wiley & Sons, Inc., New York, N. Y., 1965. xiii and 788 pp. $15.

REVIEWED BY H. W. BUTLER[6]

THIS VOLUME, in two parts, is a general treatise, a research report, and a new textbook. The degree to which the authors have succeeded in meeting such mutually incompatible objectives will be determined only by the collective experience of the respective users of this novel treatment of the subject.

Part I contains thirty chapters "designed to introduce the beginner to thermodynamics." The development is based on novel and often strange definitions of properties and statements of laws. For example, the second law is given essentially as a statement that an isolated system can reach a stable state.

Part II contains 22 chapters, the first 18 involving a redevelopment of the laws of thermodynamics based on the "law of stable equilibrium" and the Gibbs "principle of generalized inertia." Applications are made to systems involving electrolytes, ionized gases, general fields, and relativity. The last four chapters deal with irreversible processes, but not from the continuum viewpoint.

The book contains seven appendixes, including tables of data, applications, quantum mechanics, and answers to problems.

The basic philosophy of the presentation is axiomatic; thermodynamics is developed essentially as a branch of geometry. Whether this will produce better future engineering thermodynamicists is an open question.

Friction and Wear

Friction and Wear of Materials. By E. Rabinowicz. John Wiley & Sons, Inc., New York, N. Y., 1965. Cloth, $6^1/_4 \times 9^1/_4$ in., x and 244 pp. $12.

REVIEWED BY R. I. TANNER[7]

AS THE author says, there are few monographs or research workers dealing with the important subject of wear. The two volumes on friction by Bowden and Tabor, for example, devote only one short chapter to wear. Therefore the present book is very welcome, providing a simply written alternative view based on the specific surface energy (W) concept developed by the author. It is honestly admitted that some of the ideas expressed are not universally accepted, and at times one gets the impression that phenomena are forced to depend on surface energy whether they like it or not. For example, on p. 66 we are told that the friction coefficient depends on the dimensionless group W/pr, where p and r are the yield pressure and the "welded" junction radius, respectively. Later, on p. 161, we find r is a multiple of W/p, which seems to imply that the friction coefficient is independent of W/p, although the contrary is reiterated throughout the book. Despite such objections, the misprints and the misspellings, the work is full of interesting useful observations on the actual behavior of surfaces.

Beams and Frames

Plastic Analysis and Design. Vol. 1, Beams and Frames. By C. E. Massonet and M. A. Save. Blaisdell Publishing Co., New York, N. Y., 1965. Cloth, 379 pp. $10.50.

As Professor Prager states in his Preface to the English edition: "Special features of the present book made a translation particularly worthwhile. Without sacrificing rigor, the authors have reduced mathematical developments as far as possible. They have also refrained from using mathematical notation unfamiliar to engineers. On the other hand, they have not hesitated to discuss numerous practical questions that are not normally regarded as falling within the scope of the theory of plastic analysis and design. In this manner, they have achieved a remarkably lucid presentation, which is addressed to engineers interested in the solution of practical problems."—*Ed.*

[6] Professor and Chairman, Department of Mechanical Engineering, West Virginia University, Morgantown, W. Va.