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Book Reviews

Science of Materials

Structure and Property of Materials, vol. 1; Thermodynamics of Structure, vol. 2. Edited by John Wulff. John Wiley & Sons, Inc., New York, N. Y., 1964. Paper, 216 and 232 pp., respectively. $2.95 per volume.

REVIEWED BY M. H. RICHMAN[1]

THIS WORK by John Wulff and his associates consists of four individual volumes each devoted to a different aspect of materials science. The subjects of the various volumes are as follows: (1) Structure, (2) Thermodynamics of Structures, (3) Mechanical Behavior, and (4) Electronic Properties. The series is designed to offer a comprehensive introduction to the structure, properties and behavior of solid materials—metals, polymers, and ceramics. The authors have tried to balance the physics and chemistry of solids and have placed emphasis on the principles relating properties and behavior to structure and environment. At present, only volumes 1 and 2 are available for review.

The authors have designed this work as a text for a two-semester introductory course in materials for engineering and science majors at the sophomore-junior level. The need for such a text is indeed a real one, but the authors have not been successful in accomplishing this in the first two volumes of the series. The division of the subject matter into four volumes has resulted in some repetition, but the main failure is that thoroughness has been sacrificed for brevity.

It is understandable that a comprehensive work on the science of materials would be undesirably long, but the terse treatment found in volumes 1 and 2 has made the book not only qualitative but sketchy. Materials science has a definite mathematical basis, be it in the area of thermodynamics metallurgy or solid mechanics, but little quantitative analysis is to be found in these volumes. Even as a qualitative work much essential material has not been discussed; for example, in 13 pages the reader is taken through the first three laws of thermodynamics and the concept of free energy.

In conclusion, one can only hope that the two volumes yet to be published can tie together the bits and pieces of information scattered throughout the first two volumes because, as such, this series does not serve as an adequate text for a sophomore-junior introductory course.

Elastic Systems

Dynamic Stability of Elastic Systems. By V. V. Bolotin; translated by V. I. Weingarten, L. B. Greszczuk, K. N. Trigoroff, and K. D. Gallegos. Holden-Day, Inc., San Francisco, Calif., 1964. Cloth, 6 × 9 in., xii and 451 pp. $12.95.

REVIEWED BY E. T. CRANCH[2]

THIS translation from the original Russian book treats a class of problems where certain external loads on an elastic system parametrically excite a dynamic response. Since much of the original research appears in German or Russian journals, this translation is especially valuable to many workers in applied mechanics. The author has for the first time gathered in one extensively referenced volume an imposing array of examples collected both from his own research and that of others.

The loading is essentially restricted to cases having a sinusoidal time dependence, thus resulting in a response characterized by a system of coupled Mathieu equations. The criteria are given for the uncoupling of the governing equations. Thus, Part 1 is mainly devoted to the parametric vibrations of a simply supported compressed rod with damping and the nonlinear effects of concentrated mass and stiffness included. Part 3 treats the analogous problems for curved rods, frames, plates and shells, as well as beams in which coupled bending-torsion motion occurs. Part 2 presents the underlying common origin of these problems after reviews of matrix theory, integral equations, and certain properties of the solution of linear differential equations with periodic coefficients. Pertinent approximate methods of analysis are given. Limited experimental evidence is cited.

Though not slighting mathematical difficulties, the book is written "through engineering eyes" with clear presentations of the physical origin of the problems and concluding estimates of the magnitudes of the effects considered.

Gas Bearings

Gas Lubricated Bearings. Edited by N. S. Grassam and J. W. Powell. Butterworths, London, England, 1964. Cloth, 6 × 9 in., xvi and 309 pp. $19.

REVIEWED BY R. I. TANNER[3]

NINE AUTHORS have pooled their knowledge of gas bearing technology to provide a very wide coverage of the subject. Self-acting, externally pressurized, and hybrid bearings are considered. Design charts for common bearing configurations are presented together with explicit rules for use and some worked examples. A proper concern for stiffness and stability is evinced throughout; recipes for use by production engineers are also offered.

This skillfully edited book will be of the greatest use to those about to enter the field of practical gas bearing design; it will appeal especially to those not wishing to study the manifold techniques for solving the governing differential equations. It is *not* an introduction to the theory of the subject, despite editorial implication. The special applications studied are rather lopsided, for they deal mainly with intrinsically clean systems (e.g., nuclear reactor auxiliaries, gyroscopes, dental drills); only the final article deals with the application of gas bearings to common industrial problems in machine tools and metrology. This reviewer suggests that the final chapter should be read first to gain an idea of some of the problems which may face the designer and user of industrial gas bearings.

Magnetohydrodynamics

Linearized Analysis of One-Dimensional Magnetohydrodynamic Flows. By Roy M. Gunderson. Springer Tracts in Natural Philosophy, vol. 1, Springer Verlag, Germany, 1964. Bound, 6 × 9 in., viii and 119 pp. $5.50.

REVIEWED BY F. SCHULTZ-GRUNOW[4]

THIS BOOK is concerned with nonisentropic perturbations traveling in an ideal, inviscid gas subjected to a magnetic field transverse to the velocity of perturbation in the case of infinitely large electrical but infinitely small thermal conductivity. First, the propagation of nonuniform shock waves in an initially uniform flow is considered. The effects of nonuniform cross-sectional area variations on the propagation and additional effects of small nonuniformities in piston motion on a piston-driven shock are discussed without taking into account shock reflection. This leads to area versus shock-strength relationships which are valid for finite continuous area changes. Later, effects of small heat addition to an initially uniform flow are studied. The derivations make frequent reference to the corresponding relationships in conventional gas dynamics; this points out the similarity of the mathematical methods used and provides a clear insight into the characteristics of the additional, electrodynamic influences.

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