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Book Reviews

Theory of Elastic Thin Shells. By A. L. GOLDENVEIZER. Translation from the Russian edited by G. Hermann. International Series of Monographs on Aeronautics and Astronautics. Pergamon Press, New York, 1961. 658 pp. $15.00.

The book appears to have been produced by the photo-offset process from a typewritten manuscript. Although the monograph is legible, except for a few blurred areas, it is not generally conducive to pleasant reading.

The author has subdivided the content of the book into five major parts. The first part contains an introduction into the theory of surfaces, and the derivation of the geometric and load relationships present in a general shell element. These relationships are presented in arbitrary curvilinear coordinates and in orthogonal curvilinear coordinates. Part I concludes with the equations of compatibility, the equations of equilibrium, and the mathematical specification of boundary conditions.

Part II is devoted to the membrane theory of shells. In contrast to the direct approach in the development of shell membrane theory the author has chosen to treat this facet of shell analysis as a limiting condition that can be obtained from the general theory of shell flexure. In this section the author has restricted himself to shells of cylindrical, spherical, and conical configuration. He has, intentionally, not included typical surfaces of revolution such as roof domes and liquid containers which are analyzed by membrane theory.

The third part of the monograph deals exclusively with circular cylindrical shells. The relationships and equations developed in Parts I and II are applied to cylindrical shells, generally the simplest type to analyze. Trigonometric series are used principally in the analysis of these shells, and approximate methods are developed for the solution of the problems. These methods, which are used extensively in the text that follows, are first introduced here, since the methods are best demonstrated when applied to a simple geometrical configuration. The development of the approximate methods of treatment of shell problems is one of the primary objectives of the book.

In Part IV of the monograph a detailed mathematical study is made of the approximate methods used in shell analysis. The author examines the methods of asymptotic integration as the shell thickness approaches zero. Part of the text is devoted to a discussion of the circular cylinder equations which have received considerable attention in America, and are known here as the Donnell equations.

The methods developed in the preceding parts of the book are applied in Part V to the solution of problems by membrane theory and by bending theory. The approximate methods are applied to edge effect problems and to the bending of cylindrical and conical shells.

The author has confined himself to a very general but mathematically comprehensive treatment of the theory of shells. Since a rigorous solution of these problems is normally not possible, the mathematical analysis is largely concerned with asymptotic and approximate methods. In his effort not to duplicate material that has already been adequately covered in other Russian books dealing with this subject he has produced a rather specialized monograph on the generalized mathematical approach to the solution of shell problems. For this reason the book is not useful as a general reference text.

The average engineer with a limited mathematical background will find this book too difficult to cope with. Other books on the subject, such as Timoshenko's "Theory of Plates and Shells," or Fluegge's "Statik und Dynamik der Schalen" will generally be of greater practical value to the average shell designer. For those that need to dig deeper into the subject, the mathematical techniques presented in this book will be of great value.

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(About the Reviewer: David Burgreen is a Consulting Engineer at the Development Division of the United Nuclear Corporation. For the past 12 years he has been concerned with the applied mechanics aspects of nuclear engineering, including the statics and dynamics of structures.)

Introduction to Nuclear Science. By ALVIN GLASSNER. Van Nostrand, Princeton, N. J. 213 pp. $3.75.

The preface to this book indicates the level and organization of the text with the observation that the book resulted from a series of courses or lectures presented to high school science teachers at Argonne National Laboratory. "Lectures were usually given by experts in the field, who took pains to keep them at an appropriate non-technical level. Mathematics was employed only to the extent that the diversified backgrounds of the teachers would permit." Thus the text is an elementary survey of nuclear science and engineering topics with little analysis. A tremendous amount of material is covered but only in a descriptive manner. It is a book, therefore, which would be of interest to a beginner who would like to get a speaking knowledge of a large portion of the nuclear field.

Topics covered in the book include nuclear particles, reactions of nuclei, radioactive decay, detection of radiation, accelerators, reactors, reactor fuels, and biological effects of radiation. There are no problems in the book and few example problems. The language of the text is rather complete in nuclear terms and should be a good reference book

for high school science teachers. It should also be of interest to those in nontechnical work who would like to become acquainted with the nuclear field. It is not recommended as a text for college use.

The last section of the book is devoted to a series of diverse experiments or demonstrations which can be performed with a "minimum of special equipment." Several of the experiments involve the construction or assembly of equipment which can be used as part of other experiments. The outlines of experiments are very concise showing the materials to be gathered, the procedures or methods to follow, and the results or conclusions that should be reached. The experiments range from the response of yeast cells to irradiation (ultraviolet) to the fabrication of fuel elements. The latter experiment obviously requires some special equipment.

The book is well written and serves as an excellent introduction to the field of nuclear science and engineering.

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(About the Reviewer: P. F. Pasqua is Professor and Department Head in the Nuclear Engineering Department of the University of Tennessee. He has been on the staff of that university for the past nine years. He obtained his Ph.D. at Northwestern University in 1952.)

Rare Earth Alloys, A Critical Review of the Alloy Systems of the Rare Earth, Scandium and Yttrium Metals. By Karl A. Gschneider, Jr. Van Nostrand, Princeton, N. J., 1961. 449 + xiii pp. $12.75.

Scientists whose field includes the rare earth metals should be interested when a man who works at the Los Alamos Scientific Laboratory writes a book on alloys of the lanthanons. When this man has previously worked with Spedding and Daane at the Ames Laboratory and has received the PhD at Iowa State University, the probability is strong that the book will be good and that the author will know whereof he speaks.

Dr. Karl A. Gschneider, Jr. has made a very scholarly effort to collect and to evaluate data critically on the physical metallurgy of alloys containing one or more of the lanthanons, scandium, or yttrium. Data not readily accessible in the United States, particularly information published in some rather obscure Russian journals and books, are included. One hundred phase equilibrium diagrams have been redrawn after being carefully checked against all available sources of information.

The book is well-written. Organized into four sections, its first part deals with the physical properties of the metals themselves. The second section is given over to presentation of the phase equilibrium diagrams, together with an excellent discussion of some applicable portions of the theory of physical metallurgy. A particularly well-written discussion of the Hume-Rothery Rules and the related Darken and Gurry Plots furnishes some meat for the first section of Part II. Darken and Gurry ellipses for eight of the lanthanons are presented in the book. Part III is a carefully and critically evaluated collation of the crystallographic data on the lanthanons, yttrium, and scandium. Part IV, consisting of a list of all references cited in the previous parts of the book, actually forms a bibliography on rare earth alloys with 653 entries.

One of the most useful aspects of this book is the excellent job of indexing. All binary systems are indexed separately, followed by an index to multicomponent systems. A one-page index to structure types is useful, as is the complete author index.

Many people feel that a book reviewer has not done a good job unless he finds something about which to complain. In order not to disappoint these good people, your present reviewer would make a point that Dr. Gschneider, in his urgent efforts to pick the brains of the eminent Russian experts, may have overlooked a few items of good American work. For instance, the work of Robertson and Kato, at the Albany Station of the U. S. Bureau of Mines, was rather inadequately covered. Kato's work on the dysprosium–zirconium system, complemented by that of Ray and Wasielewski at KAPL on additions of dysprosium to Zircaloy-2, was missed. However, in defense of the author, it was impossible to find, even with reasonably diligent searching, any place in the book "Rare Earth Alloys" where Dr. Gschneider laid claim to complete coverage of all the bits of published information in this broad field.

This is a good book. The style of writing is excellent. Dr. Gschneider says briefly and lucidly what he means. The text is easily understood. No efforts at pedantry were found, and most of the book could be read with understanding and profit by even senior undergraduate level college students of metallurgy or physical chemistry. The format for the book is slightly unconventional, but not in any sense offensive. On the contrary, the format serves its purpose quite well, improving the facility with which the book may be used for reference. This reviewer can only join Dr. Gschneider in recommending the book to those physicists, chemists, and metallurgists engaged in research "in the field of metals" as well as solid state physicists, physical chemists, and engineers who have even a passing idea that some alloy containing yttrium, scandium, or one or more of the lanthanon metals might help them to arrive more quickly at some desirable end.

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(About the Reviewer: Dr. W. Kermit Anderson is Consultant—Materials Engineering to the staff of the Materials Development Operation at the Knolls Atomic Power Laboratory. Trained in chemical engineering and physical chemistry at the Agricultural and Mechanical College of Texas, he received the first PhD granted by that institution in the physical sciences. His interest in the rare earths was first aroused at Oak Ridge during a search for high efficiency shielding materials while employed by the NEPA project. This interest was maintained during employment at the Argonne National Laboratory and, more recently, at the Knolls Atomic Power Laboratory, where his desire to apply the lanthanons as absorbers for control of reactors has led to several publications in the field.)

Protective Construction in a Nuclear Age. Proceedings of the Second Protective Construction Symposium: The Rand Corporation. J. J. O'Sullivan, editor. Macmillan, New York, 1961. 2 vols., 884 pp. $25.00.

Collected in these two volumes are 45 papers presented at the Second Rand Corporation Protective Construction