Book Reviews

Annual Review of Energy: Volume 2. Jack M. Hollander, Editor; Melvin K. Simmons and David O. Wood, Associate Editors. Annual Reviews, Inc., Palo Alto, California (1977). 521 pp. $17.00.

This is the second in a series of annual reviews devoted to a continuing review and discussion of significant issues related to energy. Volume 1 was devoted to a review of energy technologies and policy issues related to the production and use of energy in the U.S. This second volume is devoted to the global energy situation and the complex of international and national issues arising from the diversity of production, trade, and demand for energy. The book is well planned and executed and constitutes a valuable reference volume and data source for world energy concerns.

The book opens with an overview section on global energy resources and the complex global energy system based on them, with a separate chapter devoted to the history and current dimensions of international energy trade. This is followed by three chapters devoted to economic and political issues growing out of the policy alternatives for the major energy importing nations, the role of multinational oil companies, and a survey of computer models of the global and international energy system.

These two sections are followed by chapters on the intimate dependence of food on energy, the potential effect on world climate of CO_2 from the burning of fossil fuels, the problem of international safeguards of nuclear fuels, and the potential for conservation of energy.

The last half of the book is made up of a group of well-informed and excellent papers on energy problems and issues of particular regions. The regions covered are Central America, the People's Republic of China, Western Europe, India, Japan, the OPEC countries, Sweden, and the USSR. Each is written by an expert or experts in the industrial, economic, social, and political structures of the region they cover. They reveal as no other approach could the great diversity of energy issues among different sections of the world, as well as the diversity of attitudes and approaches for their resolution. Such a collection could not aspire to be comprehensive, but it is somewhat unfortunate that it did not also include Brazil. The same type of treatment for North America has previously been included in Vol. 1.

This is an authoritative, well-planned, and carefully executed contribution to the important field of global energy policy analysis. Within the immense volume of published material in this field, this book should be given a very high priority for the libraries of individuals and institutions working in this field.

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About the Reviewer: W. G. Pollard, now retired from the executive directorship of Oak Ridge Associated Universities (originally ORINS), was instrumental in forming that conglomerate, which has been influential in furthering the sciences in the southeast. That service followed contribution, during the war years, to the development of the gaseous-diffusion separation process of the uranium isotopes. Dr. Pollard's graduate training in physics was at Rice, which was followed by a professorship at the University of Tennessee.

Isotope Separation. By Stelio Villani. American Nuclear Society, La Grange Park, Illinois (1976). 416 pp. $29.80.

The publication of American Nuclear Society monographs has the goal of "providing to the nuclear community and related fields authoritative information in monograph form." This goal is well served by the publication of *Isotope Separation*, authored by Stelio Villani. This monograph brings together a wealth of information about isotope separation drawn from many sources. It provides the reader with material relating to the scientific, engineering, and economic aspects of several important techniques for isotope separation. The major processes currently in use for large-scale isotope separation are presented in a reasonably complete fashion as they existed in the early 1970's. In many areas, the author is hampered by security classification and thus is limited to material available in the published scientific and technical literature. Nevertheless, within this limitation, Villani succeeds in transmitting to the reader the nature and magnitude of a relatively new industry that is currently an important part of our society.

The monograph begins with three introductory chapters describing the isotopic makeup of the elements, methods of isotopic analysis, and the physical principles of isotope separation. In the third chapter, some basic nomenclature is introduced, and the physics and chemistry of a group of isotope separation processes are briefly discussed. This chapter is not one of the better chapters in the book. As often happens, an attempt to oversimplify the physics of some phenomenon can lead to statements that are misleading or incorrect. For example, on p. 35 the author states that in a gas mixture in thermal equilibrium, the square of the mean velocity of the various molecules is inversely proportional to the square root of the mass, while on p. 69 we find a statement that the flow rate for Poiseuille flow through a capillary is proportional to the square of the pressure drop. These are incorrect and probably represent an oversight in proof reading. A more serious error appears in the discussion of thermal diffusion on p. 75. Here, the author's "simplistic view" of the physics of thermal diffusion presents instead the mechanism of thermal transpiration (a transport induced by a temperature difference under free molecule conditions), which bears no relation to the process of thermal diffusion in a gas mixture under continuum conditions. Fortunately, these errors do not propagate into the remainder of the monograph, and ultimately the reader can find the correct equations for the analysis of the

various processes either in the monograph or in one of the references given in the bibliography at the end of the chapter.

Chapter 4 is a fairly complete and self-contained exposition of the theory of ideal and square cascades. Some attention is given to cascade optimization, but time-dependent cascade behavior, which is important for cascade control, is only treated briefly in a discussion of the equilibrium time of a cascade. The theory developed in this chapter is used repeatedly in the discussion of the specific isotope separation processes that make up the remaining chapters of the monograph.

Chapters 5 through 13 present detailed discussions of specific isotope separation processes that currently are, or have been, used for the large-scale production of isotopes. The processes covered in these chapters are gaseous diffusion, centrifugation, hydrogen distillation, electrolysis, exchange-reaction, and electromagnetic separation. These chapters are the core of the monograph. Within the limits of security classification, they present a reasonably complete description of the status of each process based on information available through about 1972. Each chapter includes a summary of the physical and chemical principles underlying the technique, a discussion of unique engineering problems associated with each process, a description of plant size equipment and plant operation, and, where possible, a study of the economic factors that help dictate plant design. The information provided in these sections of the monograph would normally be accessible to a reader only by searching and surveying a wide variety of publications, some of which are not readily available in the usual library collection.

As an illustration of the coverage provided in Chaps. 5 through 13, consider Chap. 5, which deals with the gaseous diffusion process for the production of uranium enriched in ^{235}U from naturally occurring uranium, which contains ~0.7% ^{235}U. The chapter begins with a presentation of a theory of flow through porous barriers under conditions pertinent to the gaseous diffusion process. This is followed by a brief presentation of the various ways in which a gaseous diffusion stage can be operated and of the arrangement of stages in a cascade. After mentioning some of the particular materials problems encountered in the process, the chapter continues with a discussion of the factors governing the choice of operating conditions of a plant, plant construction features and operating problems, and a description of production plants currently in operation. The chapter ends with a presentation of the economics of the gaseous diffusion process.

Chapters 6 through 13 are organized in a fashion similar to Chap. 5, although not all of them are as complete. Lack of completeness, when it occurs, can almost always be attributed to the inaccessibility of information due to security classification or to the fact that the detailed physics describing the process is not completely known. Each of these last chapters is followed by an excellent categorized bibliography, which can guide the reader who is interested in further details.

To meet the energy needs of the world in the coming decades, it is anticipated that new plants for uranium enrichment will be needed starting in the mid or late 1980's. This fact makes the publication of this monograph particularly timely. For those interested in large-scale isotope enrichment, the monograph provides a useful source of information concerning the techniques and problems associated with this field.

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About the Reviewer: Abraham S. Berman is a professor in the Department of Aerospace Engineering and Mechanics at the University of Minnesota. His interest in isotope separation dates from the war years, when he was a member of the research staff of the Manhattan Project's SAM laboratories and of the Oak Ridge Gaseous Diffusion Plant. Dr. Berman's undergraduate training was at the College of the City of New York, followed by a graduate degree from Ohio State. He presently serves on advisory committees to the centrifugation project.

Modern Formulas for Statics and Dynamics: A Stress and Strain Approach. By Walter D. Pilkey and Pin Yu Chang. McGraw-Hill Book Company, New York (1978). 418 pp. $18.50.

The stated purpose of this book is to fill the gap between handbook formulas and large-scale, general-purpose computer programs. Clearly, the book is successful in achieving that goal. As an extension of handbook formulas to include more complex situations that are amenable to batch and/or remote-terminal computer solutions, this book should find wide acceptance among practicing design engineers.

Each chapter is well organized, incorporating a logical presentation of subject matter. The first part of a typical chapter outlines the basic applicable formulas. Tables usually follow that contain, for example, geometric properties, loading functions, initial parameters, transfer matrices, and natural frequencies. The tables are easy to read and follow, a fact that contributes significantly to the success of the book. The layout and organization of the tables will be of great benefit to the engineer who must work rapidly and have access to information with a minimum of effort.

Many of the formulas listed in the tables are in a ready-to-use format, as one would find in the typical sort of engineering handbook. Others, where more complex geometries are involved, are presented in conjunction with the transfer matrix method, and additional formulas incorporate finite element procedures. The presentation of these latter two methods is made more convenient by noting the pertinent computer programs that are available and how these programs can be obtained by the engineer.

The book is applications oriented, so that there is no real attempt at development of the formulas presented. However, for a given situation, e.g., simple and complex beams, the tables clearly show the appropriate modifications that are necessary as the specific application changes, so that extensive background (and/or review) in the area should not be necessary for an engineer with some design experience. For those readers who feel a review would be helpful, reasonably extensive reference material is provided.

The tables include transfer matrices for numerous situations that a designer could be expected to encounter. As a further aid, an appendix is provided that outlines several techniques for deriving transfer matrices. The authors recognize that use of the transfer matrix method can, in some cases, be hindered by numerical difficulties. A second appendix is provided that outlines the use of the Riccati transformation, in combination with the transfer matrix, in overcoming these difficulties.

There are several solved illustrative examples in each section of the book. Should the user have his own computer program available, these examples will allow him to verify the accuracy of his program. Furthermore, the examples would be of benefit to the engineer seeking to refresh his background in the area by doing practice problems. The particular computer