BOOK REVIEWS

Selection of books for review is based on the editors opinions regarding possible reader interest and on the availability of the book to the editors. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

Nuclear-Reactor Analysis

Author	Allan F. Henry
Publisher	The M.I.T. Press
Pages	547
Price	$27.50
Reviewer	Alexander Sesonske

The analytical description of reactor core neutron behavior occupies a central role in the discipline that has evolved as nuclear engineering, and contributes many of the unique characteristics of that discipline. A new book devoted to this subject is therefore of major interest, particularly when the author is as experienced as Allan Henry.

This book is not only useful as a text but will appeal to experienced nuclear engineers since its approach is to provide a theoretical foundation for the analysis and design of reactor cores, rather than merely a presentation of reactor physics theory.

The book's 11 chapters cover a wide range and serve as the basis for a sequence of three graduate courses in reactor theory given at the Massachusetts Institute of Technology. The author claims that no prior knowledge of either nuclear physics or reactor physics is assumed, and the mathematical level is about that provided by standard undergraduate engineering training. Although this statement may be true in a strict sense on the basis of mathematical topics with which the reader is assumed to be familiar, considerable mathematical sophistication in these very areas is needed to work through the various developments, which in most cases are merely outlined. Similarly, the reader without prior nuclear or reactor physics would just not derive the benefits that the book has to offer in providing a number of interesting viewpoints that tend to build on previous knowledge.

A chapter-by-chapter discussion provides a picture of the book's contents. Although the introductory chapter provides some interesting perspectives, it is superficial. Most readers are likely to prefer other sources to develop background about the general nature of nuclear reactors.

The book's approach is to develop initially the neutron balance relations, including energy dependency, for an infinite system rather than beginning with "one-speed" diffusion theory, as is often the case. The stage is set for this in Chap. 2 concerned with reaction rate terms and followed by Chap. 3, which deals with the neutron balance equation using the multigroup approach.

Finite systems are treated in the subsequent chapter, devoted to diffusion theory, which concludes with a reasonably comprehensive two-group theory treatment and a discussion of the multigroup approach. This concludes the material intended for the first-semester course.

Chapter 5 is a welcome practical discussion of the determination of multigroup constants in the presence of resonance absorbers. Following this is a lucid treatment of the consequences of fuel depletion, which also is practically oriented.

The second-semester material concludes with a short chapter on reactor kinetics, which is minimal, but may be appropriate for a course with little time for this subject. Considering the author's many contributions in reactor kinetics, this chapter tends to be disappointing.

The subsequent material, which comprises almost 40% of the book, is intended for the advanced course of the three-term sequence. Two of these chapters are devoted to transport theory and development of diffusion theory approximations. Another chapter describes the important problem of generating parameters for diffusion theory methods based on practical cores. The final chapter describes advanced methods for reactor analysis such as synthesis approaches and finite-element methods. Only a few general references are provided at the end of each chapter.

Fast reactor analysis is not specifically treated although certain topics discussed such as multigroup methods are applicable to fast systems. Only brief mention is made of breeding and breeders in the fuel depletion chapter.

Although the book provides a large number of problems that might be assigned to students at the end of each chapter, there are no worked out examples within the chapters. In order to provide such a broad treatment within reasonable space, much of the mathematical development is necessarily sketchy. The book must therefore be supplemented by a skilled instructor to develop the material and lead the student so that applications are possible.

In fact, the desire to provide one text intended to train a beginner, with sufficient material provided so that he is an expert at the end of the book, just requires the coverage of too much territory. Completeness at every stage is clearly impractical.

On the other hand, a major contribution of the book is refreshing

discussion that provides excellent insight and a practical orientation for readers who have some previous knowledge of the subject material. Dr. Henry's many years of experience with analysis methods certainly enrich the presentation.

An instructor will have to judge for himself the appropriateness of the book as a text for his use since there are a number of features that differ from prevailing presentation styles and he needs to be sympathetic with the kind of treatment used. Readers who have already a reasonable grasp of the basic material will enjoy the insights provided and find the book an excellent reference. It therefore represents a significant contribution to the nuclear engineering literature that is likely to fulfill many needs.

Alexander Sesonske is professor of nuclear engineering at Purdue University. His association with numerous nuclear engineering programs dates back to the Manhattan Project and includes activities at Los Alamos Scientific Laboratory and other national laboratories. He is co-author, with Samuel Glasstone, of Nuclear Reactor Engineering *and author of* Nuclear Power Plant Design Analysis. *In addition, he has contributed many research articles in the areas of liquid-metal heat transfer, nuclear fuel management, and reactor engineering.*