fission power systems and an important inclusion of some of the facts, definitions, and standards encountered in radiobiology. Though the emphasis is on fission power, radioactive decay power and fusion power are not neglected.

The first few chapters serve as an introduction to the concepts, nomenclature, and units underlying any discussion of energetics and nuclear reactions. Then follows a detailed discussion of the three major energy-producing nuclear reactions—radioactive decay, fission, and fusion—with some estimation of their practical importance as energy resources. A chapter on the interactions of radiation in matter introduces and explains quite nicely such concepts as the microscopic and macroscopic cross section, mean-free-path, attenuation coefficient, and charged particle range. Then, the environmental impact of the exploitation of nuclear energy sources is brought under discussion—particularly the impact of nuclear radiation (neutrons, charged particles, gamma rays) on the biological environment. The notion of dose and the relation between dose and biological damage are introduced and cautiously quantified. Next is the presentation of some details of fission product decay chains, with emphasis on their importance to fission power system design because of delayed neutrons, fission product poisoning, and decay thermal power. Finally, there is a long chapter leading to a description of various kinds of fission power systems (fast versus thermal, water cooled versus gas cooled, etc.) followed by a brief, but adequate, chapter devoted to the speculative magnetic and inertial confinement fusion power systems.

The book is replete with sample problems designed to help the reader comprehend new concepts as they are introduced. Each chapter ends with a problem set, thus enhancing the value of the book as a text. The level of presentation of technical material and the selection of content make this work particularly suitable for use in sophomore- or junior-level survey courses offered to non-nuclear engineers and other applied scientists. In my opinion and as the author suggests, this book should also serve as a useful reference for practicing engineers and scientists not specifically versed in nuclear engineering.

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About the Reviewer: Dick Osborn, professor of nuclear engineering at the University of Michigan for more than a decade, received his academic training at Michigan State and at Case. Dr. Osborn was a member of the scientific staff of the Oak Ridge National Laboratory during the early 1950's. His research and teaching interest are in nuclear and plasma physics.

Computational Methods in Engineering and Science. By S. Nakamura. John Wiley and Sons, Inc. (1977). 457 pp. $25.00.

Numerical analysis plays an extremely important role in the design and analysis of nuclear systems. For many years, nuclear engineering programs have sought to include more material on numerical methods and digital computing in their curricula. Unfortunately, existing texts that treat the application of numerical methods to nuclear systems are either quite dated (e.g., Clark and Hansen's *Numerical Methods of Reactor Analysis* or Bell and Glasstone's *Nuclear Reactor Theory*) or far too advanced for the typical engineering student (e.g., Wachspress's *Iterative Solution of Elliptic Systems*). Shoichiro Nakamura's new text, *Computational Methods in Engineering and Science*, addresses this need by developing the principal methods of numerical analysis used in the design of nuclear systems at a level suitable for senior or first-year graduate nuclear engineering students.

Nakamura's text is particularly noteworthy in treating computational methods for fluid dynamics with the same thoroughness as the more traditional subject of numerical methods for solving the neutron diffusion equation, in recognition of the importance of thermal-hydraulics analysis in modern nuclear systems design. After a brief introduction to the usual topics in numerical analysis, the author proceeds to develop the more popular numerical methods for the analysis of ordinary and partial differential equations, with particular emphasis on eigenvalue problems, iterative methods for solving elliptic partial differential equations, parabolic partial differential equations, and the hydrodynamics equations. Additional topics include weighted residual and variational methods, finite element methods, coarse-mesh rebalancing, Monte Carlo methods, and several advanced topics in transonic aerodynamic flow. The text is distinguished by its extensive use of detailed examples to illustrate mathematical concepts as they arise. Nakamura has also provided a comprehensive set of problems for each chapter.

We were particularly impressed by the appearance of a number of topics that play a vital role in modern methods of nuclear analysis but that rarely are encountered in textbooks. Among these subjects are the use of both cell-centered and cell-cornered mesh structures for deriving difference equations, the control volume approach to fluid systems, a careful discussion of implicit versus explicit methods for solving time-dependent problems, finite element methods for both diffusion and fluid flow problems, and advanced methods such as the strongly implicit procedure (SIP) methods for solving elliptic partial differential equations. We were somewhat disappointed at the absence of a discussion of discrete-ordinates methods (particularly since a chapter was devoted to Monte Carlo methods). We would also question the devotion of entire chapters to both coarse-mesh rebalancing methods and transonic aerodynamic flow (although we recognize that the author has made very significant research contributions to each of these areas).

We are somewhat concerned about the background necessary for an adequate appreciation of the material included in the text. Although the author states in the preface that only a preliminary knowledge of linear algebra and matrices is necessary, early in the first chapter he assumes as well a background in basic numerical analysis. Furthermore, it is apparent that the reader must have had a thorough course in nuclear reactor analysis (including multigroup diffusion and source iteration methods), along with some exposure to fluid dynamics (to the level of the Navier-Stokes equations) to appreciate the material covered in the text.

Although the text could serve as a primary text in a specialized course on numerical methods in nuclear systems analysis, we believe that its most effective use would be as a supplementary reference in advanced courses on nuclear analysis and design at the graduate level. The degree to which the text is oriented to nuclear systems analysis would seem to inhibit its effective use outside of nuclear engineering programs.

We would recommend Nakamura's text as a bridge between the more thorough and rigorous (and necessary) courses in numerical analysis taught by applied mathematics programs and the practical applications of numerical methods taught in courses on nuclear systems design and analysis.

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