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Book Reviews

Physics of Nuclear Reactors. By D. Jakeman. American Elsevier Publishing Co. Inc., Great Britain (1966). 351 pp. $10.00.

This book, as part of the *Applied Physics Guides* edited by Sir Graham Sutton, is, according to the publisher, ". . . intended for graduate engineers and physicists who wish to become acquainted with the branch of physics dealing with nuclear reactors. No prior knowledge of the subject is assumed, but it is anticipated that the reader will be familiar with calculus and elementary nuclear physics."

The book consists of nine chapters, starting with the usual Introduction, followed by an elementary discussion of The Behavior of Neutrons in Non-multiplying Materials, Slowing Down with Capture, Neutron Thermalization, Behavior of Neutrons in Multiplying Systems, Fast Reactors, Thermal Reactors, Nuclear Fuels, and Reactivity Changes and Control. The material presented has been covered many times in other books and in the readily available literature produced in profusion by various laboratories and journals. A review must then be confined to an assessment of how well the author has met the original intent of offering a guideline to the physics of nuclear reactors.

First, the book cannot be recommended as a textbook for a first course in reactor theory. As admitted by the author himself, the treatment of the subject varies considerably in depth from chapter to chapter. The Introduction is inadequate in three respects, particularly for those not trained in physics. A more complete discussion of neutron-nuclei interactions is needed. Second, a thorough and well-organized discussion of the fundamental problems of reactor physics would be needed if this book were to serve as a "guideline." Finally, too many concepts are presented without adequate discussion. A great deal of supplementary reading would be required by a novice to fully appreciate the material presented in the Introduction. Incidentally, the opening statement in this book referring to the discovery of fission is not correct. Meitner and Frisch were the first to suggest fission as the correct interpretation of the work of Hahn and Strassman (see S. Glasstone, *Sourcebook on Atomic Energy*, 2nd Ed., p. 385-389, D. Van Nostrand Inc., Princeton, N. J. (1958)).

Chapter 2, which concerns the Behavior of Neutrons in Nonmultiplying Materials, is very good. The presentation of a solution for a point source at the center of a finite sphere using eigenfunctions of the Helmholtz equation, and the accompanying illustrations showing the effect of higher harmonics, should prove very helpful in giving the beginner an insight into neutron diffusion.

Chapter 3 on Slowing Down with Capture is not really adequate for an introduction to this material. (The reviewer must admit, however, that he has not yet seen an adequate introductory discussion of resonance capture in any of the literature.) The definition and the discussion of the effective resonance integral is very sketchy. The discussion of the effect of heterogeneities is deferred to Chap. 7 where the presentation is not complete enough to serve as a foundation for understanding resonance absorption in heterogeneous reactors. Although the references provided at the end of these two chapters are reasonably sufficient, the reviewer would like to point out that the method of making heterogeneous systems equivalent to homogeneous systems was first developed by Bakshi rather than Chernick and Vernon, as stated by the author on page 252 (see P. Bakshi, BNL-4381, Brookhaven National Laboratory, Upton, New York (1959).

The chapter on Neutron Thermalization is a very good introduction, although omission of at least references to the work of Nelkin, Honeck, Brown, and St. John on thermalization in H_2O and D_2O should be considered a serious omission at this time in history.

The remaining chapters are reasonably easy to read and should offer the beginner very little difficulty. The book has many tables and illustrations of experimental data and calculations which are useful. On the other hand, many of the definitions and concepts are introduced in a rather loose manner and the organization of some of the material could be improved. The author states in the Preface, "An attempt has been made in the present book to preserve a balance between the older and the current approach to the subject." This reviewer does not believe he has achieved his goal. The omission of a discussion of multigroup theory and the important developments in this field during the last decade upset the balance.

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About the Reviewer: Milton C. Edlund, now Professor of Nuclear Engineering at the University of Michigan, was formerly with The Babcock & Wilcox Company where he served over a period of 11 years successively as Manager of Mathematics and Physics, Manager of Development and, recently, Assistant Manager of the Atomic Energy Division. Prior to this, he was with ORNL, where he initiated the Reactor Physics course at ORSORT and co-authored The Elements of Nuclear Reactor Theory *with Samuel Glasstone in 1951. He received his BS and MS in physics and, recently, a PhD in nuclear science from the University of Michigan. In 1965 he was given the E. O. Lawrence Memorial Award for his contributions to reactor development.*

Proceedings of Physics and Chemistry of Fission Symposium, Vol. I and II. Published by International Atomic Energy Agency. (Symposium held March 1965), Vol I, 635 pages. $13.00; Vol. II, 469 pages. $10.00.

In March 1965, a symposium on the Physics and Chemistry of Fission was held in Salzburg, Austria. Printed proceedings of the nine working sessions, now available in