Book Reviews

Neutron Transport Theory (La teoria del trasporto dei neutroni, in Italian), Vols. I and II. By Vinicio Boffi. Nuclear Reactor Physics Series, Pàtron Publisher, Bologna, Italy (1974). Vol. I, 457+ pp.; Vol. II, 761+ pp.

The author of this ponderous book, which has required two distinct volumes to handle the matter, is well known for his long-time deep involvement in the analysis of rigorous solutions to the mathematical problems raised by neutron transport theory. It is only logical, then, that the author should collect in book form a comprehensive account of his University teaching and research. As one would expect, this text, which is a re-elaboration of Boffi's lectures in a course on Reactor Physics, bears predominantly on thorough mathematical discussions of the problems which can be tackled analytically, more than—as is more typical of articles and reports—on the search for approximate solutions to nonidealized practical problems.

With this premise, I think it is fair to say that, while acknowledging the wide variety of the subjects treated and the impeccable rigor of the mathematical investigation, I would have found the text more effective if, even at the expense of sacrificing some discussions, it had been slimmed down to a more concise form. The author should be credited, however, with a great merit. As is appropriate for a teaching course, nothing is taken for granted, and every part of the book is a self-sustaining sub-monograph, a feature that justifies why the discussion of a few subjects is repeated in different sections with only marginally different formalisms.

The book structure is logically perfect: In Vol. I (Integral Transport Theory for One-Speed Neutrons), the author reviews the kernel method and the integral form of the transport equation, from which he derives the diffusion equation in both the time-dependent and the steady-state cases. The volume is completed by a vast collection of solutions to the diffusion equation, no trivial achievement when we recall that single-collision kernels are derived from diffusion kernels.

Volume II (Integro-Differential Transport Equation) deals with one-speed steady-state problems, multivelocity steady-state problems, and—in less detail—with time-dependent problems. As regards the one-speed steady-state case, the excellent layout of the singular eigenfunctions method should be noted even though such a method is once again credited to Case (1960), whereas it should perhaps be attributed to two Frenchmen, P. Lafore and J. P. Millot, who published exactly that method (with all the basic examples) in the October 1958 issue of *Industries Atomiques*. As far as spectral problems are concerned, the author did well to include in his section on thermalization the (generalized) degenerate kernel along with the heavy gas model. However, it would have been worthwhile to add a few words on Cadilhac and Soulé's "secondary model," a model that has a far wider field of application than the heavy gas model without being appreciably more complicated. Among other things, an extremely instructive discussion can be found (in Chap. V.6.B) on the derivation of broad-group-averaged P_1-type equations, the form of which is shown to depend on the *type* of space-energy separability assumed at the start.

From the viewpoint of the themes discussed, this is a very detailed and self-sustaining monograph; from the editorial viewpoint, in addition to the fact that the size of the volumes would have deserved a hard cover, I have noted a few inconsistencies that shall easily be remedied in future editions:

1. In Vol. I, the running heads on the pages do not indicate the chapter, but give only the volume title on the right side; from page 317 on, the word "integral" is missing in that title. In Vol. II, the left running head gives chapter number, the right running head gives the chapter title (which is better).
2. Volume I is provided with a "corrigendum," but Vol. 2 has none.

These are peanuts, however, that cannot modify the positive judgment on the methodology followed, a methodology relying on a courageous rigor which is an all-time feature of Boffi's theoretical research.

R. A. Bonalumi

Centro Informazioni Studi Esperienze
Via Redecesio, 12
Segrate, Milano, Italy

March 12, 1975

About the Reviewer: Riccardo A. Bonalumi is a senior researcher at the CISE laboratories located near Milano, Italy, where he is responsible for the Reactor Analysis and Computations Branch and where he previously served in the area of reactor physics and design as an experimentalist, an integral transport theory theoretician, head of the Reactor Physics Section, Associate Director of the Design Studies Section, and scientific advisor to the Design and Analysis Division. Educated in Italy, with extended stays in the U.S. and France, he taught at Milano Polytechnic School and also held a position at Combustion Engineering in Windsor, Connecticut in 1970. His work in reactor physics and analysis devoted to the collision probability theory in the 1960's has shifted since 1970 toward problems related to the redefinition of reactor parameters and problems related to multidimensional analysis of light-water reactors. Professor Bonalumi is a member of the Editorial Advisory Boards of Annals of Nuclear Energy *and of* Energia Nucleare.