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.

COVER CLAIMS CONFIRMED

Title Physics of Nuclear Kinetics

Author G. Robert Keepin

Publisher Addison-Wesley Publishing Company, Inc., 1965

Pages ix + 435

Price $12.50

Reviewer A. F. Henry

It is fairly rare for a reviewer to feel that the summary of a book as it appears on the fly leaf of the cover accurately conveys his own impression of the contents. *Physics of Nuclear Kinetics* provides an exception to this rule. In fact, the publisher's description of the contents and flavor of Dr. Keepin's book coincides sufficiently with my own evaluation that I can do little better than begin by quoting the first two paragraphs of it:

"This book assembles in one place the latest and best basic fission data and reactor kinetics data in precise, clear, and directly usable form. It then develops in detail the role of these basic data in determining the dynamic behavior of nuclear chain reacting systems. Throughout the text the emphasis is on the 'physics' of nuclear kinetics. Assuming a knowledge of the fundamentals of nuclear physics and reactor theory, this book is well suited for senior graduate-level courses in nuclear kinetics and reactor kinetics. It also provides an excellent standard reference source for all practicing reactor scientists and engineers.

In essence, the book is divided into two major parts: The first five chapters describe the 'intensive' properties of neutrons with particular attention to the physics of neutron-induced fission. The remaining chapters are then devoted to the 'extensive' or macroscopic behavior of neutron populations in bulk media, and the resulting implications for reactor kinetic response and system stability."

The only significant reservation I have about completely endorsing these paragraphs involves the implied ordering of the groups for whom *Physics of Nuclear Kinetics* will be useful. In my opinion the book will be of greatest value as a standard reference source for practicing reactor scientists and engineers. It will also be suitable for senior graduate-level courses in reactor kinetics. However, some amplification of motivation and background material may be necessary if the book is to be used for such a purpose. To me it has more the flavor of a series of first-rate review articles rather than that of a textbook. For example, there are some 560 references cited.

The intensive properties of the fission process covered in the first half of the book include discussions of energy, mass and charge distribution in binary fission, prompt neutrons and gamma rays from fission, delayed neutrons and their precursors, and delayed fission gamma rays and photoneutrons. Many tables and graphs of valuable data are contained in these sections.

The second part of the book is oriented toward reactor kinetics measurements and their analysis. It starts with an introductory chapter dealing with the derivation of the reactor kinetics equations, definitions of parameters, and treatment of space-time situations. Succeeding chapters deal with asymptotic period-reactivity relations, determination of reactivity and the other kinetic parameters, response to transients, transfer functions, and system stability. Most of these phenomena are analyzed by a fixed flux-shape approximation (the so-called "point-kinetics equations"). As a result, theoretical expressions for second-order effects are not derived, and, although Dr. Keepin is careful to point out qualitatively possible sources of error in this approach, no quantitative way of evaluating these errors is provided. My personal preference would be to analyze all these phenomena using a variational principle made stationary by the correct solution of the space-time neutron and precursor equations. This procedure would yield quantitative expressions for correcting the simple formulae. It would also, I believe, unify the presentation.

Physics of Nuclear Kinetics is an excellent compendium of most of the information needed as input

to analyze reactor kinetic measurements. It presents clear descriptions of the measurements themselves—along with many extremely pertinent observations about possible sources of error, both theoretical and experimental. In many cases the theoretical analysis relating to the measurements is carried out only to the first order, and the theoretical tools for a more thorough approach are not developed. This omission (which, of course, may be intentional) makes the book somewhat incomplete. Nevertheless, I recommend it as a most valuable adjunct in dealing with practical kinetics problems.

Allan F. Henry received his BS in Chemistry from Yale University in 1945. He returned to Yale and obtained an MA in Physics in 1947 and a PhD in 1950 with a theoretical thesis in the area of microwave spectroscopy. In 1950 he joined the Westinghouse Bettis Atomic Power Laboratory and worked on the design of the Nautilus core with particular emphasis in the field on reactor kinetics. He is at present in charge of the Reactor Theory and Methods Group in the analysis and development department at Bettis.

A VALUABLE TEXT

Title Experimental Reactor Analysis and Radiation Measurements

Author Donald D. Glower

Publisher McGraw-Hill Book Company, 1965

Pages xiii + 348

Price $13.50

Reviewer T. G. Williamson

It is a pleasure to find a new book that includes almost everything one has been teaching in a course and find it presented clearly and in enough detail to make a valuable text. *Experimental Reactor Analysis and Radiation Measurements* by Donald D. Glower is just such a book.

The author has written a laboratory text that includes some 60 experiments in the areas of basic radiation measurements, subcritical assemblies, pulsed-neutron-source experiments, shielding, radiation effects, nuclear reactors, and reactor kinetics. The experiments range in complexity and degree of sophistication from introductory experiments on detection elements to more advanced techniques such as measurement of reactor conversion ratio and reactor noise analysis. Each experiment is presented in a format similar to that which a student report might be expected to follow, i.e., a) purpose, b) introduction and theory, c) experimental apparatus, d) procedure, e) analysis of results, and f) topics for discussion. About half of the experiments can be done in an afternoon lab with equipment ordinarily present at a research reactor facility, critical laboratory, or in a laboratory with only a subcritical assembly and a pulsed source. Some of the rest of the experiments require more specialized equipment or are of such nature as to lead to longer term projects or even graduate theses.

The experimental procedures are written in general terms in such a manner that they can be applied at each facility. As the experiments progress to the more sophisticated, the procedures become more general, leaving most of the experiment to the design of the students. Each experiment includes a section on topics for discussion, which includes several thought-provoking questions which could lead to valuable class discussions or become a large part of the student reports.

The author makes good use of references. In nearly all experiments he refers to a standard text or to a primary source in a readily available journal. At the end of the second chapter there is a bibliography with 57 entries, relative to the contents of the previous chapter. However, one wonders why such bibliographies do not appear at the end of the other chapters.

One can always be critical of a book if it doesn't meet all preconceived ideas of what its content should be. For example, I would like to have seen more shielding experiments (various source geometries, albedo measurements, slant incidence, etc.), more than one paragraph devoted to measuring the fast fission factor, and a little more emphasis on the concept of dollars and cents as units of measured reactivity. However, these are minor points and should not be allowed to detract from the overall excellence of the book.

In his preface the author states that the book is not for use in a training laboratory in which radiation counting skills are taught, and in the text he doesn't place great emphasis on instrumentation or simple counting techniques. Rather, he makes liberal references to other books in this field, particularly *Nuclear Radiation Detection* by Price. He further states that ". . . particular care has been taken to include basic experiments which require academic proficiency at the M.S. and Ph.D. student level." He has successfully attained the goal, in my opinion, of producing a graduate-level text book. The book is a valuable addition to the library of the reactor experimentalist. Students and teachers will find many good experiments and procedures; the researcher will find it a good reference for experimental techniques with which he is not intimately associated.

Thomas G. Williamson received his BS from the Virginia Military Institute, his MS from Rensselaer Polytechnic Institute, and his PhD from the University of Virginia, all in physics. He has worked at Alco Products as a nuclear engineer and has been on the faculty at the University of Virginia where he is presently Associate Professor of Nuclear Engineering.

A REVIEW AND A HALF

Title Ceramics for Advanced Technologies

Editors John E. Hove and William C. Riley

Publisher John Wiley & Sons, 1965