systems originally presented at a symposium at the University of Arizona, March 23-25, 1970. The lengthly delay in publication (February 1972) might, on the surface, appear to seriously depreciate the worth of the volume. However, this reviewer found that the general quality of the papers was such that the book should still be of value to both practitioners and researchers in the dynamics area. An amazingly low price ($14.50) in light of the very professional typeset, hardbound book is an added inducement. Further, for many of his admirers, the keynote address by the late Theos Thompson is worth the price alone.

Dr. Thompson suggested that a theme for the conference be: "Solve *real* problems and solve them correctly." While this may seem self-evident, those involved in reactor kinetics will recognize that certain areas of the field and some symposia have been prone to a rather academic approach which has had little impact on real reactor development. A strong point of the present collection is that it contains exceptionally good balance and thereby avoids this pitfall. Thus the reader finds papers ranging from pulse and wave propagation on to a discussion of disassembly in oxide-fueled fast reactors; he finds a paper which discusses industrial requirements and also one which outlines LMFBR safety analysis requirements, as well as a fairly extensive collection of papers on recent numerical and analytic analysis techniques. In fact, the author list reads like a condensed version of *Who's Who* in reactor dynamics. Further, contrary to what one might anticipate in such a situation, the authors, in general, do not rest on their laurels—a gratifying attempt to present new material as well as to review the state-of-the-art is found. The papers went through a galley stage, and the authors and editor are to be complimented on their obvious hard work to obtain an even style and reduce errors which often mar symposium collections.

On the negative side, as is typical of such proceedings, some unevenness in quality is observed. Perhaps more distressing is the lack of continuity. There is no real attempt at unification. Critical reviews or summary papers in each of the rather diverse areas included would have helped, along with an index. Such additions should have been practical here in view of the lengthy delay in publication.

Overall, however, it is the reviewer's opinion that this collection should be a valuable addition to technical libraries as well as to the bookshelf of anyone specializing in reactor dynamics. I believe that the results would have met the expectations of Theos Thompson, and I sincerely hope that the University of Arizona can continue the tradition of symposia in reactor dynamics. This has been a real service to the reactor community over the years.

*George H. Miley, professor of nuclear and electrical engineering, University of Illinois, has been involved in the area of reactor dynamics since he reported the first reactor neutron pulse propagation experiments in 1962. In addition to his contributions in this area and pulsed research reactor studies, he has contributed heavily to research in both energy conversion and fusion technology. Author of the ANS monograph on* Direct Conversion of Nuclear Radiation Energy, *he has participated in the formation of both the Education Division and the Technical Group for Fusion of the American Nuclear Society, and has served as chairman of the American Society for Engineering Education Energy Conversion Committee.*

## Radiation and Shielding in Space

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| *Author* | James W. Haffner |
| *Publisher* | Academic Press Inc. (1967) |
| *Pages* | 347 |
| *Price* | $17.50 |
| *Reviewer* | S. H. Turkel |

This book represents a summary of the knowledge concerning space radiation and the technical disciplines of shielding against it as of the year 1966. In the specialized nature of this scientific field, the age of such information (about six years now) could frequently impose large questions of obsolescence due to rapid changes in knowledge, techniques, and application. In this case, however, a firm foundation has been established for continued usefulness to both scientists and designers. New advances in understanding the environment of space and exploring its regions with manned and unmanned spacecraft should only bring enhancement of powerful tools already established. One must only suggest that a summary of this subject is highly desirable as a continuing progress report at least once every seven to ten years in order to bring the understandings and techniques up to date, and to provide current guides to more effective space exploration and spacecraft design. Hence, the time is soon approaching for another progress report.

The author has chosen a commendable division of subject matter for the summary, dividing it into four distinct sections. The first three chapters deal with the nuclear radiation environment in space, consisting of those regions dominated by solar particle radiation, galactic (cosmic) radiation, and the earth's trapped radiation belts. The next section consists of a chapter on the effects of nuclear radiation on men and materials. The third section has three chapters dealing with the techniques of measurement of dose and dose rates as a function of shield thickness and the methods of calculating the interactions of charged and uncharged particles and radiation with matter; scattering and attenuation problems are explored and some space radiation shielding computer codes are described. The final section consists of two chapters in which the results of several space radiation shielding studies are presented which integrate the subjects of the preceding sections and their effects on overall spacecraft design; these treat the influence of doses due to nuclear space radiation: of solar flares, trapped radiation, or galactic radiation on spacecraft shielding, and of atmospheric and magnetic effects on earth shielding; and finally the influences on mission analysis considerations for earth orbital and deep space missions. Tables and graphs are used to present a large part of the material and abundant references are provided for those desiring more detail on any section. Despite the apparent cutoff of material due to the extensive source bibliography covered for each subject, a commendable coherence and completeness is achieved in this book.

The book is written clearly and graphically and should be a valuable reference to radiation scholars and workers. It remains, however, a scholarly work and would require practical design supplements for designers and mission planners. This need is not to its detriment, as other sources and applications of this source should provide these supplements. It is nevertheless a "must" reference work for any activity, academic or applied, having reference to or relevance to the nuclear radiation environment in space.

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### Mathematical Methods in Nuclear Reactor Dynamics

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| *Authors* | Ziya Akcasu, Gerald S. Lellouche, and Louis M. Shotkin |
| *Publisher* | Academic Press Inc. |
| *Pages* | 460 |
| *Price* | $22.00 |
| *Reviewers* | T. F. Parkinson and S. K. Loyalka |

The potential customers for this book are, according to the dust cover, ". . . research workers and graduate students in nuclear engineering and . . . engineers who design control systems for nuclear reactors." The book is derived from lectures developed by Professor Akcasu and should serve as a suitable text for a graduate level course in reactor dynamics. A very thorough treatment of dynamics based on the point-reactor model is presented. The textual material in six of the seven chapters is supplemented by problems which enhance the pedagogical value of the book.

The authors first discuss the neutron transport equation and then derive the various model kinetic equations in a consistent and clear fashion. The simple model equations are treated in considerable detail and a very lucid presentation of the problems which can be solved exactly is given in Chaps. 1, 2, and 3. Chapter 4 is devoted to approximate solutions of the point kinetic equations without feedback and again the treatment is clear and easy to follow.

The authors begin with the development of feedback models in Chap. 5, and the final two chapters contain a detailed analysis of linear and nonlinear stability. Various stability criteria are developed and are then used to study the feedback models.

While this book gives a very thorough mathematical treatment of the point reactor kinetics, its usefulness as a text is somewhat limited by the constraints of the point model. A very cursory discussion of the physical aspects of actual reactors is given and no space is devoted to the use of digital or analog computational techniques. No mention is made of the effect of photoneutrons on kinetics, and the topics of space-dependent effects and noise analysis are not covered. Since the usual one semester graduate course in reactor dynamics should cover these topics also, it is likely that this book should be used in conjunction with other works (e.g., recent books by Stacey, Mohler and Shen, Hetrick, Weaver, Ash, Schultz, etc.).

There are a few typographical errors in the book but these did not appear excessive. Very good reference lists with entries as late as 1970 are given at the end of each chapter.

In summary, this book will undoubtedly prove useful as a text in the area of reactor dynamics; it should also serve as a convenient reference for engineers concerned with reactor stability and control.

*S. K. Loyalka is an assistant professor of nuclear engineering at the University of Missouri-Columbia. He took his graduate work in nuclear engineering at Stanford University where he received the PhD degree in 1967. Following his graduate studies, he joined the staff at the University of Missouri-Columbia. During the period 1969-1971, Professor Loyalka was a visiting scientist at the Max Planck Institut für Strömungsforschung. He teaches classes in reactor kinetics, transport theory, and mathematical methods in engineering. His research interests are in the areas of reactor analysis and the applications of transport theory to rarefied gases. T. F. Parkinson is professor and chairman of nuclear engineering at the University of Missouri-Columbia. Following graduate work in physics at the University of Virginia, he worked for seven years for E. I. du Pont de Nemours and Company at the Savannah River Laboratory. He taught in the Department of Nuclear Engineering Sciences at the University of Florida from 1960 until 1967 when he joined the staff at the University of Missouri-Columbia. His research and teaching interests are in the areas of reactor physics and neutron spectrometry.*

### The Fermi Surfaces of Metals

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| *Author* | Arthur P. Cracknell |
| *Publisher* | Harper & Row (1972) |
| *Pages* | 283 |
| *Price* | $11.25 |
| *Reviewer* | Richard A. Young |

The study of the Fermi surface provides one of the most sensitive methods of determining the one-electron energy levels (band structure) of metals. Furthermore, a knowledge of the Fermi surface provides a spring board for a more complete understanding of the thermal, electrical, and magnetic properties of metals. In this monograph Professor Cracknell reviews the present level of our understanding of the Fermi surface in elemental metals.

The book is organized into two parts. In Part I the Fermi surfaces of what the author calls $s$ and $p$ block metals are discussed. These metals consist basically of those elements for which only the outermost $s$ and $p$ orbital valence