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.

Dynamics of Nuclear Reactors

Author David L. Hetrick

Publisher University of Chicago Press

Pages 542

Price $18.50

Reviewer M. A. Schultz

The subject of reactor dynamics has from the beginning of nuclear reactor technology fascinated many people. Hundreds of articles have been written on the subject, as well as dozens of books. The reason for this popularity is that reactor dynamics problems are useful excercises that not only have manageable mathematical solutions, but also that the approximations to these solutions give real life answers accurate enough to be used for design purposes. However, many problem solvers in the field have continually reinvented the wheel and provided several different forms of solutions especially formulated for their own particular problem.

Consequently, it was a real delight to see much of this material carefully put together, summarized using one set of common notation, and cleaned up in a logical fashion. The University of Arizona has long been in the forefront of teaching and writing in the fields of reactor kinetics and dynamics and Professor Hetrick's new book will further advance that position.

The book is stated to be used as a text for undergraduate seniors and graduate students in nuclear engineering. Mathematical knowledge of differential equations, Laplace transforms, and an acquaintanceship with matrices are required. This knowledge will get the reader through the first two thirds of the book, but it is likely that beyond Chap. 7 the text will be found most suitable for bright graduate students.

The text is concerned mostly with point source black-box reactor dynamics and every conceivable type of input including variations on steady state, ramp, step, and sine wave inputs are extensively treated. The concept of the transfer function is developed, as are hypergeometric functions and integral solutions. Numerous forms of output solutions for these various inputs are provided. All the common approximate solutions are also presented.

The text then works its way into feedback situations and, of course, when one mentions feedback, the subject of stability always arises. In our field, which from the beginning has borrowed heavily from other fields, a dazzling array of stability criteria have been used and the student is often puzzled in trying to give a simple answer to the question, "Is it stable?"

Happily, Hetrick logically straightens this out. The reader is led through all the common stability criteria starting with Routh, Niquist, and root-locus methods for linear reactor systems. The methods and criteria of Liapunov, Welton, Lagrange, and Popov are introduced in the handling of nonlinear stability problems and by the conclusion of Chap. 7 the stability situation is nicely placed in its proper perspective.

The text then goes on into space-dependent neutron dynamics and again the numerous articles in the field are compressed and fitted into general approaches. Numerical methods of handling the spatial problems are presented with some emphasis being placed on Kaplan's type of solution. The text concludes with a short summary of neutron waves. This section may or may not be appropriate but, because it is an area of progression into which many of the advanced dynamacists ultimately attain, it seems useful to leave the student in an open area in which he can extend his own curiosity.

All reviewers must be critical of something to retain their status, but I find it hard to be critical with this book because it answers most of the usual classroom questions. The book might have been a shade more helpful for classroom work if more practical design examples had been used. The problem of how one translates analytical expressions into the design of devices that move control rods is one that many students anticipate with trepidation.

M. A. Schultz (BS, electrical engineering, MIT, 1939) is presently a professor of nuclear engineering at The Pennsylvania State University, after 30 years of industrial experience, 20 of which were in the nuclear reactor field. He is the author of one of the first books on reactor dynamics and control and together with his friend, Joe Harrer, succeeded in maintaining a monopoly in this field for many years.

Nuclear Reactor Theory

Authors George I. Bell and Samuel Glasstone

Publisher Van Nostrand Reinhold Company

Pages 619

Price $24.50

Reviewer Dale R. Metcalf

This book is highly mathematical in content and provides a treatment of some topics in advanced reactor