expense of the more commonplace makes it a very poor pedagogical instrument for the uninitiated.

Robert W. Albrecht

University of Washington
Seattle, Washington 98195

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About the reviewer: Bob Albrecht is a professor of nuclear engineering at the University of Washington. He has been teaching nuclear reactor dynamics for the past 11 years and doing research related to stochastic fluctuations in nuclear reactor observables. Dr. Albrecht obtained his PhD at the University of Michigan in 1961 and received the Mark Mills award in that year for a paper based on his dissertation. During 1967-1968 he spent a year doing research at Kernforschungszentrum Karlsruhe.

Optimal Control of Nuclear Reactors. By Ronald R. Mohler and C. N. Shen. Academic Press, Inc., New York (1971). 320 pp.

This book is based on and primarily features specific research by the authors in the control of nuclear powered rocket engines. Its first two chapters give a condensed survey of reactor kinetics and optimal control fundamentals to refresh the memories of those already knowledgeable in these areas. Readers not so qualifying are likely to be left "standing at the starting gate." The last chapter gives selected optimal control topics from other sources. Remaining is the main body of the text which is devoted to analytical and numerical applications in nuclear rocket control.

Typical subjects treated from the standpoint of their utilization in optimal control are the Euler-Lagrange equation, the Bellman-Hamilton-Jacobi equation, the maximum principle, and linear programming. Typical problems solved utilizing these methods are reactor startups with minimum time or minimum propellant consumption. In these problems typical imposed constraints would be not exceeding control capabilities or not exceeding limits on thermal stresses.

A more descriptive book title might be "Optimal Control Theory and Its Application to Nuclear Rockets." While the needs of rocketry are quite unique and specialized, nevertheless many general aspects of control theory and applications are clearly presented. In this respect the two control chapters written by Shen are outstanding. They overlap and repeat some material in Mohler's chapters. But perhaps Shen goes too far in lucidity when a step by step numerical conversion is given to show 1 g/cm^3 of water contains 6.94 lb/ft^3 of hydrogen.

The chapters by Mohler also are largely derivations of reactivity control methods of achieving a minimum cost (ex., fuel usage) functional. A variety of methods is treated in detail—even down to pages of FORTRAN statements of a quasi-linear programming algorithm. Computer utilization in achieving results is a necessity and here this book is quite up to date.

Specific examples of results—graphs of power, reactivity etc. during rocket startups—are frequent. These remind one of the practical utility of the methods presented. The reader is therefore intermittently brought back from the abstract world of the calculus of variations and into the world of concrete practical reality. Also assisting in this respect are discussions of the physical processes involved and of intuitive rationale for results obtained.

There is no special glossary, though Shen's chapters define some terms as they are used. A policy for defining control and reactor jargon or for defining lesser used mathematical terms might exist in a school text, but would not be required in a book of this nature, aimed at the experienced specialized researcher. An example of the lack of a policy is defining "bang-bang" control on the last pages, after it has been repeatedly mentioned throughout the book.

It is not to be expected from the book title that one would find an excellent treatment of heat transfer and thermal stresses spanning a third of a chapter, and also lucid extensive discussions of the neutron kinetics equations at various places. But with these topics adequately treated in many texts, it would have been better to devote their space to control theory—such as expanding the variety of optimum control topics in the last chapter.

The authors intended this book for systems theoreticians, nuclear engineers with a strong background in control theory, and graduate students specializing in this field. It will well serve this select group, who, moreover, should no doubt find the bibliographies listing original papers well worth pursuing.

J. A. Thie

P.O. Box 517
Barrington, Illinois 60010

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About the Reviewer: Joseph A. Thie is an independent consultant to the reactor industry. Prior to 1960 he pioneered in boiling water reactor development at Argonne National Laboratory. Subsequently he has been a consultant for utilities and manufacturers in the fields of reactor design, experimentation operation, and safety. Among his publications are many papers treating random fluctuations, including his book Reactor Noise. Other books which he has either authored or coauthored are Heavy Water Exponential Experiments Using ThO_2 and UO_2, Nuclear Reactor Instrumentation Systems, and The Technology of Nuclear Reactor Safety.

Fast Reactor Safety. By John Graham. Academic Press, Inc., New York (Dec. 1971). 367 pp. $18.00.

The author's preface states that this book is intended "as a university text for reactor safety applied to fast reactors in general and applied to liquid metal-cooled fast breeders (LMFBRs) in particular." The author also intends the book "as a text for graduates and undergraduates in nuclear engineering who are attending courses in reactor safety." Within this context, the book approaches its objective, albeit with mixed success and a rather different emphasis than I might choose. The publisher's statement on the book jacket that "this volume presents the latest information on the whole field of safety as applied to the fast breeder reactor power system," however, is not valid. Nor is the jacket statement that the book will be of "great interest to . . . practicing nuclear engineers and power engineers who want to acquire a working knowledge of nuclear safety." Finally, by way of introduction, the book does not, as stated in the forward by J. J. Taylor, "examine, as quantitatively as our present technological capability permits, the specific features of safety of the fast system."