computations. But many parts of the book that deal with these peripheral subjects could be substantially improved.

E. M. Gelbard

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About the Reviewer: Dr. Gelbard is an Advisory Scientist at the Bettis Atomic Power Laboratory, and a Fellow of the ANS. He received a PhD in Physics at the University of Chicago in 1954. Since that time he has worked at Bettis, where he has specialized in the development of numerical methods for use in reactor physics computations.

Neutron Noise, Waves and Pulse Propagation. AEC Symposium Series 9, CONF-660206 (May 1967). 761 pp. $3.00.

This book is the proceedings of a symposium held at the University of Florida in February, 1966. As such, it is a record of the status of the field at that time. Comparison with the Proceedings of the previous Florida conference (*Noise Analysis in Nuclear Systems*, AEC Symposium Series 4, TID-7679), held just over two years prior, shows how the field had developed during that interval.

A few specific topics will serve as examples. First, there is the technique of pseudorandom binary cross correlation. The original work on the technique was reported at the previous conference. The present conference had a number of papers dealing with the use of the technique in the measurement of transfer functions of critical and subcritical reactors and the determination of the characteristics of nuclear-rocket propellant systems.

Another new technique that was discussed by its originators is the method of measuring reactor noise by taking the cross correlation between the signals from two detectors. This simplifies the interpretation of the measurements by giving the detection-noise component a zero expectation value, and allows some relaxation of the detection-efficiency requirement.

There is also mention of the "polarity correlation" method of noise analysis, in which correlation functions are calculated for two-valued variables, whose values at any time depend upon whether the corresponding observed random variables are above or below their means. The method greatly facilitates the use of digital techniques at a cost of very little loss of information.

A great deal of work is reported, both theoretical and experimental, in the area of space-dependent reactor kinetics. A large segment of this deals with neutron-pulse and neutron-wave experiments and their interpretation in terms of dispersion functions. It is shown that results of the P_1 approximation (telegrapher's equation) do not agree with the experimental data as well as do those of diffusion theory, although the difference appears only at very high frequencies.

Consideration is given to the application of noise analysis to the acoustic and gamma radiation produced by reactors. Finally, there is a great deal of theoretical and experimental work directed toward the application, extension, and elucidation of older methods of noise analysis.

The papers are of uniformly high quality, and are well ordered by subject. The physical quality of the book is excellent. However, because of the $1\frac{1}{2}$-year publication delay, the book does not show the very latest advances in a number of areas.

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October 30, 1967

About the Reviewer: The reviewer is a physicist at the Argonne National Laboratory where he has had interest in experimental nuclear and reactor physics, particularly in reactor kinetics and noise analysis, since 1956. Dr. Cohn had his training at the University of Chicago where he held a National Science Foundation fellowship.

Radioisotope Measurement Applications in Engineering. By Robin P. Gardner and Ralph L. Ely, Jr. Reinhold Publishing Corporation (1967). iii + 482 pp. $16.00.

This volume was prepared as a text for radioisotope methods (under the auspices of the U. S. Atomic Energy Commission). The two authors are connected with the Research Triangle Institute and North Carolina State University. The text is organized into four major subject areas: characteristics of nuclear radiation (six chapters), radiotracing (three chapters), radiogauging (four chapters), and radiography (one chapter). At the close of the book, fifteen laboratory experiments are presented which correspond to the four areas of the text.

The authors suggest the book for a two-semester, three-credit course with two lectures and one laboratory or problem period per week. The book appears to be particularly useful for teaching because of its problems and laboratory exercises.

In this text the authors' goal is to cover the basic material pertinent to applications rather than to cover a large number of applications and, as a result, the book has only limited use as a general sourcebook on radioisotope applications.

In the first part of the text, 156 pages are devoted to nuclear reactions, radioisotope decay processes, sources and interaction of radiation with matter, radiation detectors and their response, and radiation safety. This brief coverage is intended to serve as introductory material for engineers who are not familiar with radiation or radioisotopes.

The following sections of the book describe a variety of applications and reflect the experience and work of the authors. As a result of this "selective" coverage, the text will be particularly helpful to an engineer or scientist interested in a better understanding of the fundamentals and the mathematics relating to the well-described applications. The applications which are covered most thoroughly are: (1) studies of the frequency response of systems; (2) the determination of particle size by sedimentation; (3) the study of the batch grinding of coal relating to the ability to predict the size-weight distribution and to determine performance of the grinding system; (4) a study of two-component flow systems including suspensions, powder slurries, gas liquid systems (void fraction in water-steam system), and two-component liquid solutions; (5) soil moisture and density gauging; and (6) determination of salt content of aqueous solutions.

Other applications, covered in less detail, include determining: fluid properties; flow patterns and rates; leak detection; tracer dilution; isotope dilution; wear; mixing and residence time; laminar flow; diffusion and mass transfer; the statistics necessary for calculating the accuracy and sensitivity of static and continuous gauges for alpha gauging, and for beta thickness, density, and back scattering gauging.

The fifteen laboratory experiments vary widely in their difficulty. The first few on detector response and pulse measurement are relatively simple. Later experiments on particle size determination, beta particle transmission, beta particle scattering for two-component gases, salt solution density, solid density gauging, and characteristics of continuous radiogauges are relatively complex experiments which, as the authors say, could serve as subjects for term papers.

This reviewer concludes that the book should be particularly useful for teaching students in hydraulic, civil and chemical engineering about radiotracers and their application. It should also prove valuable for use by individuals interested in those applications listed above, the fundamentals of which are thoroughly covered in this book.

J. Kohl

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August 24, 1967

About the Reviewer: Jerome Kohl is currently manager of marketing at ORTEC Incorporated, Oak Ridge, Tennessee. He obtained his BS degree in applied chemistry from the California Institute of Technology and was formerly affiliated with Tracerlab Incorporated and was coordinator of special products of the General Atomic Division of General Dynamics Corporation. Mr. Kohl has been an instructor in extension courses in radioisotope applications and engineering at the University of California in Berkeley and San Diego. He is the senior author of Radioisotope Applications Engineering *and author of a chapter on industrial uses of radioisotopes in* Modern Nuclear Technology.

Modern Control Systems. By Richard C. Dorf. Addison-Wesley Publishing Company (1967). 387 pp. $12.50.

In his Preface, the author expresses an intention to assist the reader in discovering feedback control theory and practice. This is done by encouraging the inductive learning process with examples and problems interspersed among lucid explanations. Members of the pedantic deductive school must seek elsewhere for their formula derivations. Hence, the author admirably achieves his goal of instilling a creative learning process in the reader.

A double clichéd opening, "Chapter 1, Introduction to Control Systems; Section 1, Introduction," is followed by a chapter on mathematical models used in describing control systems. After explaining the fundamentals of feedback, the book treats performance specifications and stability criteria in successive chapters.

With this background, the remaining two-thirds of the book contains specific methods for system analysis: the root locus method, Bode plots, the Nyquist criterion, and time-domain analysis. A final chapter examines methods of compensating control systems to achieve desired performance.

Mason's signal flow graphs are prolific, occurring in many chapters. Perhaps this is in the hope of obtaining converts to their use. On the other hand, no space is devoted to control-related concepts of correlation and random processes.

Also perhaps conspicuous by its absence is any discussion of analog computer applications. The emphasis on digital computer usage in time-domain analysis is good. Perhaps some exposition of the time-honored usage of analog computers in control system analysis would have had educational appeal, especially to those readers who prefer electrical to algebraic thinking.

The non-matrix-oriented reader may shy away from the time-domain analysis chapter. This would be unfortunate because, as the author points out, digital computer matrix calculations facilitate this type of analysis. Hopefully, most readers will either have matrix algebra at their fingertips or will use the thoughtfully provided Appendix on the subject.

An upper-level undergraduate will have no difficulty understanding the explanations of principles, especially since a numerical example follows each. The author goes to considerable length to find fascinating control problems at the end of each chapter: Telstar, lunar landing craft, student grades, and status seeking are typical subjects. The interests of "spacemen" more than "nuclear men" receive attention, for there is scarcely more than one reactor control problem. To be sure, everyone's interest is reached at least somewhere; for example, a problem on foxes vs rabbits is even included for the child prodigy.

In summary, this book is an excellent aid to the control-theory student toward which it is aimed. It may also interest those who occasionally seek elucidations of control analysis topics.

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About the Reviewer: Joseph A. Thie is a consultant to the reactor industry, having served in this capacity since 1960. In former years at the Argonne National Laboratory he pioneered in Boiling-Water Reactor development. He has worked extensively in fields of reactor design, experimentation, and operation. Books on physics experiments, reactor kinetics, and reactor safety are among his publications.