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.

Small-Sample Reactivity Measurements in Nuclear Reactors

Author	Wesley K. Foell
Publisher	American Nuclear Society
Pages	249
Price	$23.50
Reviewer	Ratib A. Karam

Small-Sample Reactivity Measurements in Nuclear Reactors is one in a series of monographs, each covering a very specific area in the field of nuclear science. The series is sponsored by the American Nuclear Society and the U.S. Atomic Energy Commission.

The author's motivation for the monograph was "the rapidly growing application of small-sample measurement in fast reactor research and development" (Preface). Apparently this motivation was stimulated by the belief that thousands of small-sample reactivity measurements will be performed in the coming decade (Preface), yet no reasons, rational or otherwise, were given for this projection.

The scope of the monograph was limited to considerations of the experimental techniques used in the determinations of small-sample reactivity measurements (10^{-3} to 10^{-8} $\Delta k/k$) and the design and interpretation of such measurements for the purpose of: "(1) deriving information about the mechanism of neutron interaction with various materials introduced into the reactor, (2) determining certain properties of the materials themselves, e.g., cross sections, and (3) determining characteristics of the reactor itself" (Preface). On p. 84 we are told that small-sample reactivity measurements comprise three categories: (1) material parameters, (2) reactivity coefficients, and (3) reactor characteristics. The author further states that the bulk of his monograph, ". . . is concerned with the measurement of material parameters. However, categories 2 and 3 are also discussed in passing." Yet if one examines Chap. 4 one finds that the bulk of it falls under categories 2 and 3. The same is true of Chap. 5! Furthermore, in Chap. 5 the author correctly informs us (p. 201) that lack of agreement between experiment and calculations falls into three categories: "(1) incorrect cross sections for the test sample, (2) incorrect cross sections for the reactor (producing erroneous spectra), and (3) incorrect calculational techniques (including the methods for generating average group constants)." Yet in his Preface we are told that small-sample reactivity measurements are important to the determination of cross sections. How we are going to determine cross sections when either the neutron spectrum or the calculation techniques or both are uncertain is not clear and remains ambiguous. The author appears to contradict himself at times, which may be because he did not have a frame of reference or a well laid out scheme for his book.

Chapter 1 (4 pages) is a brief introduction in which an attempt was made to categorize the small-sample reactivity measurements. The attempt was culminated by choosing three categories: (1) objective of experiment, (2) complexity of sample, and (3) nature of the reactors. The categories are more of a useful description of an experiment rather than true categories. We are also introduced to the term of "more or less integral experiment" in Chap. 1. Consider the quotation (p. 4), "An experiment to measure the absorption cross section of Fe^{56} is less integral than one to measure the absorption cross section of U^{235}, in which the neutrons produced by fission complicate the reactivity vs. absorption relationship." Use of the term "more or less integral" is nebulous to say the least!

Chapter 2 (64 pages and 46 references), entitled "Techniques for Precise Reactivity Measurement," contains useful information, both historical and technical. The chapter is cluttered, however, with heavy borrowing of published material for no apparent real and useful purpose. With regard to the power—History Techniques (p. 47)—it is stated that, with the advent of on-line computers, "Instantaneous and *precise* reactivity values can be obtained." What is meant by *precise* and how the limitation of point kinetics affects this precision is left dangling.

Chapter 3 (67 pages and 68 references) is entitled "Fundamental Problems of Design and Interpretation of Reactivity Measurements." This chapter, which contains the fundamentals for reactivity measurements, is by far the best in the book as the author appears to feel at home. It is regrettable he did not use this chapter, from the beginning, as his frame of reference.

The author's review of current

material, by and large, is commendable. Chapters 4 and 5, reactivity measurements in thermal and fast systems, respectively, are also excellently written. The coverage of pertinent material is rather complete. Chapter 4 contains 50 pages and 46 references and Chap. 5 contains 47 pages and 50 references.

Despite the negative remarks made earlier, the book is a good addition to one's library in the area of measurement and analysis of reactivity coefficients.

R. A. Karam has been with the Georgia Institute of Technology for about two years; he teaches graduate students and supervises graduate research. He came to Georgia Tech from Argonne National Laboratory where he spent about 10 years performing experiments and their analyses on the fast critical facilities.

Dr. Karam graduated from the University of Florida in nuclear engineering in 1963. He has a continuing interest in the mechanics of reactor physics, cross-section averaging methods, and neutron spectra.

Energy Needs and the Environment

Editors	Robert L. Seale and Raymond A. Sierka
Publisher	University of Arizona Press (1973)
Pages	349
Price	$9.50
Reviewer	V. Lawrence Parsegian

As far as subject matter is concerned, it would be difficult to pick one that is more appropriate to the times than is suggested by the title of this volume.

The work emerged from a symposium on "Energy, the Environment, and Education" that convened in the Spring of 1971 at the University of Arizona. One cannot help noting how much the energy situation has changed in the intervening period. The substantive materials begin with "Energy Resources for Power Production" in which M. King Hubbert reproduces many graphs and data that were in his 1969 book *Resources and Man.* His emphasis is on fossil fuels, and it is interesting that after casual introduction to "solar power" a footnote adds that there is more interest now in that energy resource.

There follows a good discussion by A. J. Haagen-Smit of the pollutants that endanger the "Air Resources" of California. Victor A. Koelzer and Richard C. Tucker discuss water management problems connected with steam-electric generation, without going much outside the fences surrounding the power plant. F. A. McCrackin of the Southern California Edison Co. discusses the rapid growth of central station energy requirements, with some fear of what's ahead. R. C. Amero delves into "Transportation Energy Requirements" with analysis of fuels and engine types and their trends. An interesting item he includes is the cost (as given by H. R. Lindon) for transporting energy, in cents per million Btu over 100 mile distances: The cost is 0.6 for oil pipeline, 1.5 for gas, and 10.0 for extra-high-voltage electric lines (500 kV). The implications of this for increased use of coal through gasification or fluidization are obvious.

The next three chapters delve briefly into emissions from power plants and their control: A. L. Plumley on fossil fuel emissions, William J. Moroz on waste heat control, and D. G. Daniels and J. R. Eliason on "Thermal Emissions Control." J. G. Terrill, Jr., and W. D. Fletcher present the radiation emissions from present day pressurized water reactors and from the Dresden-I boiling water plant. There is a brief chapter on "Future Reactor Systems" by Harry Lawroski.

Albert W. DeAgazio discusses processing of spent nuclear fuels for recovery of the uranium and plutonium and for control and storage of fission products. His conclusion that "The technology is largely available at the present time to solve the problems that are yet in the future" is not too well based, in the face of questions he himself leaves unanswered. John R. Trotter's estimates of radiation levels that can be expected to accumulate by the year 2000 would be more convincing if I could find what nuclear power levels were in mind in his projections for the future. J. E. Norco discusses the implications and specifications of the Clean Air Act of 1967 and its 1970 Amendments—specifications that many people will want to postpone in favor of getting energy from any source.

T. M. Morong and J. L. Shapiro carefully and with candor describe the Navajo Project for building a huge coal-fired generating station near Page, Arizona. Sponsored by four utilities, the Los Angeles Department of Water and Power, and the U.S. Bureau of Reclamation, the project aims to meet the "challenge of environmental acceptibility," even in this region of limited water supply. We can only wish them well and wait to see the results around 1976 when there will be so many other people after the same limited water resources.

There follows a description by Ernest S. Starkman and Roger B. Sperling of how the University of California is supporting the State's air pollution research. The volume ends with a chapter titled "National Goals" by J. Frederick Weinhold of what used to be the Office of Science and Technology. As one might readily guess, there were no clear national goals at the time.

Although the volume contains much useful information of the kind environmentalists should have at their disposal before they posture against new power plants, I am not sure that its reading would (or should) calm their fears. The book lacks clear focus on issues that are substantive to the topic, and lacks even more a philosophic and engineering overview. One can take little comfort from statements such as Lawroski's "The technology for fast breeder reactor systems is essentially at hand . . ." against current realization that we are billions of dollars and two decades away from having such systems available for power use.

Perhaps the inadequacies of the volume had their cause in the organization of the symposium. One gets the idea that each speaker was permitted to say his piece and to leave for home, even when his subject required concerted effort and argument to put into perspective. Since I am about to participate in a symposium that has similar theme and publication plans, the fear is in me that we may do no better.

A nuclear physicist by formal preparation, V. Lawrence Parsegian spent the first twelve years of his career in industrial research, then