Book Reviews

Fundamental Aspects of Nuclear Reactor Fuel Elements. By Donald R. Olander. U.S. Energy Research and Development Administration, Technical Information Center, Oak Ridge, Tennessee (1976). $16.25 (soft cover). (Solutions to problems available for $13.50.)

Intended "to function both as a text for first-year graduate courses in nuclear materials and as a reference for workers involved in the materials design and performance aspects of nuclear reactors for electric power production," this volume magnificently surpasses the first objective and will certainly meet or exceed the second for years to come. Encyclopedic in approach and scope, and with over 600 pages (averaging some 850 words, an illustration, and several equations on each), this treatise is comparable to the proverbial 5-ft shelf of other books and reports in its area, all at a price less than almost any one of them, which is bound to install it as an instant favorite with students.

The main source of information is the materials problems uncovered in the development of liquid-metal fast breeder reactor fuel, most of which are also encountered in light water reactor and gas-cooled breeder reactor fuels. The first eight chapters review the sketchy background of most students in the required statistical and chemical thermodynamics, crystallography, and physical metallurgy. These principles are then applied to the properties and irradiation behavior of oxide fuels in the next eight chapters and of cladding in four more. Chapter 21 then incorporates everything into calculations of the performance of the entire fuel element.

Although the approach is analytic rather than descriptive, the clarity of the presentation is outstanding. Standard formulas are derived closely referring to the literature and theory, rather than merely presented. Consistent symbols and metric units are used to maintain continuity. Comprehensive problems, with multipart questions and guidance for their solutions, follow each chapter. A separate volume obtainable with the complete solutions will be invaluable to the assistant for grading these problems or to the instructor as an added teaching aid. Specific pertinent background reading is also cited in early chapters.

Complete chapters on "Swelling Due to Fission Gases" (64 pp.), "Pore Migration and Fuel Restructuring Kinetics (22 pp.), and "Fission Gas Release" (56 pp.) can be awe-inspiring and foreboding, and suggest letting the peripatetic "George" design the fuel. Now, with this guidance, your own patience, and a generous time assignment by your boss, you can do it yourself (maybe). Otherwise, one of Don's recent graduates can do it for you!

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About the Reviewer: Carlos Bonilla has been professor of chemical and nuclear engineering at Columbia University since 1948, with broad interests in heat transfer and the flow of fluids, especially as applied to the nuclear industry. His experience includes service at Johns Hopkins University as professor and head of the Department of Chemical Engineering and consultantships to many laboratories and government agencies. He recently received the ANS Arthur H. Compton Award and the AIChE Donald Q. Kern Award for these activities. Professor Bonilla's academic training was principally at Columbia.

Measurement of Unsteady Fluid Dynamic Phenomena. Edited by Bryan E. Richards. Hemisphere Publishing Company, Washington, D.C. (1976). 340 pp. $35.00.

This volume is part of Hemisphere Publishing Company's successful series in *Thermal and Fluids Engineering*, J. P. Hartnett and T. F. Irvine, Jr., series editors. The current book is based on a set of lectures presented by a group of experts at the Von Karman Institute for Fluid Dynamics in 1975. The intention of the lectures was to provide a current review of instruments and ancilliary equipment used for measuring and recording unsteady flow phenomena.

As in all books that consist of a number of individual contributions, there are variations in the depth of coverage and approach used. Richards provides a brief and useful introductory chapter, where he points out that unsteady fluid phenomena may be categorized as being (a) random nature (e.g., turbulent phenomena), (b) periodic flow, or (c) discrete flow unsteadyness (e.g., shock waves and runaway failures). Several aerospace examples of the various categories are then discussed briefly. The editor's introductory chapter is followed by another introductory chapter, which is meant to serve as a general introduction to unsteady flow theory. However, the chapter is too brief to be very useful to those with a good background in this area and not sufficiently basic for those who are unfamiliar with the field.

Three chapters are devoted to descriptions of measurement techniques for various parameters. The first of these considers pressures, forces, and acceleration. The following two consider heat transfer, skin friction, temperature, and gas density. These chapters are followed by chapters devoted to hot wire and film anemometers, laser-Doppler velocimetry, and combustion process measurements. The remaining four chapters are devoted to the instrumentation and techniques required to record and analyze signals from primary sensors.

The experience of the contributors to this work lies primarily in the fields of noise, turbulence, shock tubes, and related areas. This experience is reflected in the material presented. With the exception of the chapter on combustion, all of the material on primary sensors concerns single-phase fluids, primarily gases, at moderate temperatures. Much of the information presented is therefore not likely to be useful to nuclear engineers. There is no discussion of the problems encountered when dealing with liquids at high temperatures or the special instrumentation needed for two-phase (gas-liquid) systems.

The chapters most likely to be of interest to nuclear engineers are those dealing with data recording and analyzing systems. For those unfamiliar with high-speed data recording and storage, Chap. 9 provides a useful introduction. Chapters 10 and 12 consider signal analysis procedures having a fairly wide applicability. The discussion of space-time correlations presented in Chap. 11 is, however, directed toward laboratory studies of turbulence.

Those readers who are interested in instrumentation used in studies of turbulence and gas dynamics will find this volume to be a useful addition to their library. Engineers who are primarily interested in measurements related to transients in light water and liquid-metal-cooled reactors will find this volume of only limited interest.

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About the Reviewer: Joel Weisman is professor of nuclear engineering at the University of Cincinnati. His major interests are the thermal-hydraulic aspects of reactor design, two-phase flow, and reactor safety. Dr. Weisman is coauthor of the American Nuclear Society monograph Thermal Analysis of Pressurized Water Reactors *and is editor of* Elements of Nuclear Reactor Design, *recently published by Elsevier Scientific Publishing Company.*