futures. I would highly recommend it as a valuable addition for your own library of energy literature.

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About the Reviewer: Wen S. Chern is presently engaged in long-term planning of the research and development programs at the Lawrence Livermore National Laboratory. Dr. Chern's early academic training was at the National Chung-Hsing University, Taiwan, and was completed at the University of California, Berkeley, in agricultural economics. His present appointment was preceded by seven years at the Oak Ridge National Laboratory, as an economist in the Energy Division, and by professorships at the University of Florida and at the National Chung-Hsing University.

Thermohydraulics of Two-Phase Systems for Industrial Design and Nuclear Engineering. Edited by J. M. Delhaye, M. Giot, and M. L. Riethmuller, Hemisphere Publishing Corporation, Washington, D.C. (1981).

This volume is based on a lecture series at the von Karman Institute of Fluid Dynamics, Belgium, in 1978. Unavoidably, some of the contents have become outdated before its 1981 publication.

Volume I includes several basic aspects of pressurized water and liquid-metal fast breeder reactors (PWRs and LMFBRs) with chapters contributed by a number of authors.

Truly authoritative presentations by Y. Y. Hsu are given in Chap. 1, an overview of PWR and loss-of-coolant accident and emergency core cooling phenomena, Chap. 14 on boiling heat transfer, Chap. 15 on condensation heat transfer, and Chap. 19 on two-phase heat transfer computer modeling. The first three are areas of his personal research. The latter is a candid evaluation of various codes. Hsu has identified the need of in-core instrumentation and the need to improve the confidence in reactor safety margins via accurate modeling.

Definitive experiments on LMFBRs and their problems are reviewed in Chap. 2 by J. Costa. An effort on detailed modeling of the 19-pin voiding study carried out at his laboratory would be very useful, and, in fact, these experimental data can be used for validating the computer code. It would be a very desirable and timely subject to have some discussion in the areas of flow stratification and natural circulation.

Several of the chapters (Chaps. 3, 4, 5, 7, and 8) on formulation, based on first principles by J. M. Delhaye, have been published previously. Their relation to industrial design appears remote, and more work is needed to approximate these equations into a practical usable form. Furthermore, a clear delineation of relative merits and an authoritative recommendation of suitability of particular applications of the various averagings presented appear extremely useful and desirable. His excellent survey on flow regimes gives a systematic account of correlations suggested by various authors. On instrumentation, it appears desirable to clearly state that measurements by local attenuation of light or other beams (optical sensors) give linear or volumetric averages of densities or voids, while electrical probes, anemometers, and microthermometers give mass flow measurements or residence times. They give void fractions only when velocities of phases are equal. Overall, these chapters are very informative and provide a part of necessary background for multiphase flow and heat transfer.

Nucleation, friction factors, pressure drops, and critical flow are surveyed in Chaps. 6, 11, 13, and 18 by M. Giot. Their usefulness as a basic reference for engineering design is seen. Not many of the references given were published after 1974.

Regime transition in boiling heat transfer and two-phase flow instabilities and propagation phenomena are explained in Chaps. 16 and 17, written by G. Yadigaroglu. An important contribution is in identifying aspects that are not well understood, such as two-phase interaction laws and causes for oscillation of dryout points. Flow regime recognition and phenomenological approximation in the formulations are expected to continue to be a mode of computer modeling for some time to come.

D. Grand wrote chapters on pressure drops in rod bundles (Chap. 12) and two-phase calculations in LMFBRs (Chap. 20). Relating experimental pressure drop correlation to terms in the momentum equation appears useful. Two- and three-phase flow in LMFBRs at accident situations were illustrated via the SIMMER-1 code, including meltdown, but the accuracy of prediction is not known. Since modeling of sodium boiling is still in the early stage of development, much new information has been rapidly evolved since the publication of this volume.

The editors have made a good effort toward a coherent presentation. Gaps are there, and it is important to recognize that they exist. Accuracy of accident prediction has to be improved from both theoretical studies and experimental validations. Not only are the measurements challenging, but their limitations cannot be entirely eliminated. Further understanding of the physics of multiphase flow and improvements of mathematical procedures are very much needed if the formulations are to give correct modeling.

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About the Reviewer: William T. Sha is a senior scientist and manager of the Analytical Modeling Section, Components Technology Division, Argonne National Laboratory where he has been located since 1967. He is a noted developer of computational methods in the thermal-hydraulics area, and is solely or partially responsible for the development of many important computer codes, such as THUNDER, THINC, SAS, VENUS, THI3D, COMMIX, and BODYFIT. Dr. Sha's graduate training was at Columbia. He was engaged in reactor physics and heat transfer and fluid flow studies with Combustion Engineering and with Westinghouse Electric Corporation between the mid-fifties and the mid-sixties.

Structural Materials in Nuclear Power Systems. By J. T. A. Roberts. Plenum Press, New York (1981). 485 pp. $39.50.

The title of this book contains the phrase "Nuclear Power Systems" and the contents are faithful to the title. All previous books on nuclear materials have dealt almost exclusively with core materials, whereas the present monograph gives nearly equal weight to the balance of the plant. As one proceeds from the fuel element out to the turbine, the objects of concern become more massive and the materials phenomena that affect them change from principally physical to nearly exclusively chemical.

The introductory chapter gives an overview of the reactor systems (fission and fusion), their materials limitations, and the philosophy with which the latter are addressed. The