the structural integrity of the weld. Components of primary interest are those that serve as a protective reactor boundary, like thick-walled pressure vessels and valves. The presentations in general are up-to-date reviews of the present state of the art of particular aspects of nondestructive evaluation (NDE) in various countries. Questions asked of the participants and their responses follow the presentations. This publication is not a typical conference proceeding but provides an authoritative review of the present status of ultrasonic techniques of NDE in the United States, Canada, France, Germany, Japan, and the United Kingdom.

While the main emphasis in this publication is on techniques of ultrasonic testing, the first section deals with the development of other examination techniques. Emphasis in this portion of the text is on radiographic procedures and multifrequency eddy current measurements. Only a single review paper deals with acoustic emission determinations, and the authors of this paper are quite candid in their discussion of this once popular technique.

The major portion of this text contains presentations that concentrate on practical experience gained during application of new ultrasonic techniques. Various authors also address the theoretical aspects of these processes and experimental programs that are under way to analyze some of the problems that have evolved during applications of these new techniques. A comprehensive publication of the results of the Plate Inspection Steering Committee program, a multinational effort to assess the effectiveness of ultrasonic testing in detecting and assessing acceptability of defects of known size in pressure vessel steel, is also included. Critical reviews of the experimental details of this program follow along with suggestions for the current, follow-on assessment study.

This overall review of NDE by ultrasonic and other techniques should be of interest to a wide audience of practicing engineers and scientists. A final panel discussion that deals with placing in perspective the problems and needs of NDE techniques serves well as a primer for persons less familiar with these processes. The purpose of this panel discussion as stated by the editor was to bring together those persons expert in NDE with those expert in reactor operation and reactor design so that the problems associated with defect analysis could be better appreciated by both categories of personnel.

While on the staff of the University of Missouri Research Reactor Facility, Dr. Schlapper was involved in the design of experimental facilities dedicated to nondestructive evaluation of materials. With coworkers he has published several articles on the use of tailored energy neutron beams to produce tomographic images of biological and material specimens. Since January 1981, Dr. Schlapper has served as a faculty member of the nuclear engineering department and the Radiological and Health Engineering Program at Texas A&M University.

Transient Two-Phase Flow

Editors	Milton S. Plesset, Novak Zuber, and Ivan Catton
Publisher	Hemisphere Publishing Corporation (1983)
Pages	736
Price	$75.00
Reviewer	William T. Sha

These proceedings indicate a well-organized meeting for the presentation of progress reports (1981) on transient two-phase flow and are mainly related to light water reactor technology. When compared to the previous Committee on the Safety of Nuclear Installations meeting, many limitations remain, but advances and matured viewpoints are seen. The major focus was on small-break loss-of-coolant accidents.

Session 1—Measurements. It is evident that measuring any two of the three quantities, void fraction, mass flow, and velocity will give the third. The remaining challenge is still that of gaining a knowledge of configuration of phases, besides void fraction. Promise is seen in the pulsed neutron activation technique, but much remains to be done; for instance, one possibility is to use additional space-wise correlation; dispersed flows are less strongly correlated than slug flow.

Session 2—Experiments. Experiments on wave propagation in pure stratified flow show significant distortion of the interface. High-velocity adiabatic expansion appears to be a way to generate simple results for code validation. This shows the fallacy of using the pure stratified flow formulation for all configurations of multiphase flow. There are still some problems in satisfactorily understanding the physics of blowdown and reflood. Unfortunately, quench phenomena were not mentioned at all in the proceedings.

Session 3—Fundamentals. Clarification is needed in treating nonequilibrium two-phase flow, particularly the detailed dependence on rate processes. Abandoning imaginary characteristics as a physical realizable process represents a step ahead in common understanding. Quantification of flow regimes remains to be done, or a better method needs to be derived. A correct basic equation can be obtained through proper averaging procedures. Interfacial effects between phases are not well understood; more experimental work in this area is urgently needed.

Session 4—Numerical Methods. As long as the basic equations are correct, one should look for code validation as a way of determining parameters of logical constitutive relations. The development of a robust solution technique and efficient numerical scheme for two-phase flow system has made significant progress in recent years but is still a long way from reaching satisfactory resolution.

Session 5—Code Application. Application will remain limited as long as one relies on code validation as evidence of correctness of a code. A viable code should be a true computer model. This point was treated in the panel discussion.

Among the panelists' statements, agreements are seen in that computer codes, derived from sound fundamentals and aided by pertinent and accurate empirical parameters could serve the functions of design, operation (transients), and safety and licensing analyses. At this point, progress has been made on all fronts. More emphasis should be placed on the development of new measurement techniques and performing more accurate and clean separate effect experiments so that we are in the position to pin down the constitutive relations.

William T. Sha is a senior engineer and director of the Analytical Thermal Hydraulic Research Program at Argonne National Laboratory (ANL). Senior status is the highest *rating accorded a staff member at ANL. Dr. Sha has made significant contributions in computational methods for reactor design and safety. His recent pioneering work on the development of the COMMIX code, using the new porous media formulation, and the BODYFIT code, using boundary-fitted coordinate transformation for any arbitrary three-dimensional geometries, represents state-of-the-art thermal-hydraulic analysis. Dr. Sha has published approximately 200 journal papers.*

Methods of Steady-State Reactor Physics in Nuclear Design

Authors	R. Stamm'ler and M. J. Abbate
Publisher	Academic Press, Inc. (1983)
Pages	506
Price	$48.00
Reviewer	Gerald A. Schlapper

This publication presents an alternative approach to a discussion of reactor physics. It does not treat the academic side of reactor physics but instead is aimed at bridging the gap between the theory-oriented, classical textbook approach and the computer-oriented reactor analysis found in practice. Some of the areas found in traditional presentations of reactor physics are not addressed in this text. There is no detailed discussion of reactor kinetics and only limited mention of problems like the Milne problem that are primarily of academic interest. The computer-oriented techniques discussed are current and in general use. For example, the philosophy and calculational methods for code packages, such as WIMS, CPM (Electric Power Research Institute), and CASMO are presented.

As the authors clearly state, this is not an introductory text in reactor physics. The first chapter discusses the Boltzmann equation, use of nuclear data files, and the computational flow of reactor physics calculations. Obviously, previous knowledge of basic reactor physics is recommended. The computer orientation of the text also assumes that the reader has had some exposure to a high-level scientific programming language, preferably FORTRAN. Because the codes discussed employ programming techniques above those normally encountered at the introductory level, the second chapter of the book provides useful advice on advanced computer programming techniques. The third chapter completes the introductory material through description of the contents and structure of a nuclear data library.

The following three chapters address calculational methods and include the method of collisional probabilities, P_1 and diffusion theory, and the S_n method. These presentations begin with the transport equation and develop the computerized form of this equation for each of the calculational techniques. The seventh chapter of this text applies these techniques to individual pin cells for the single-energy case, while the following chapter describes in very general terms how one-group solutions are combined in a multigroup iteration scheme.

Particular difficulties that are encountered in practice, such as obtaining accurate cross sections in the resonance region, are addressed in succeeding chapters. Numerical aspects of burnup calculations are presented. Derivations of the nodal equations for core calculations used in the FLARE, TRILUX, and PRESTO programs are outlined. An interesting approach is used by the authors to limit the number of long derivations within the text. Questions applicable to these derivations are located at the end of each chapter, while an Appendix contains the answers to these questions. Review of these questions and answers provides the reader with an understanding of how the methods work and what assumptions are inherent in the use of these techniques. Another Appendix contains a list of subroutines used to calculate necessary functions, such as exponential integrals.

The presentation in the text includes a limited number of figures printed in color. Numerous references are provided at the end of each chapter for the reader who wishes to obtain a more thorough background in specific areas. A detailed subject index coupled with the use of heavier type for keywords allows one to rapidly find the applicable sections of the text. A frequent problem one encounters when reading a book of this type is that abbreviations are explained only the first time that they appear and are forgotton during subsequent reading. The authors of this book graciously include a rather complete list of abbreviations early in the text to which the reader can refer.

This publication is concerned mainly with the methods of steady-state reactor physics that are found in computer programs used in nuclear power reactor design. It contains important discussions not found in more traditional textbooks and illustrates computational aspects of several key modeling techniques. It does an admirable job of tying together normal textbook presentations and practical reactor analysis. It should be of interest to practicing nuclear engineers and reactor physicists and could serve as an instructional text at the graduate or senior undergraduate level.

After receiving his MS in nuclear engineering from the University of Missouri at Columbia in 1970, Gerald Schlapper joined the reactor operations staff of the University of Missouri Research Reactor Facility. During this time he served for 5 years as reactor physicist and was responsible for core design and burnup calculations. Dr. Schlapper received his PhD in 1977 and remained on the staff of the Research Reactor Facility until January 1981, when he assumed his current position as a faculty member of the nuclear engineering department at Texas A&M University. During his career he has served as a consultant to various government and private organizations.