concerns, the writer recommends the book to all reactor physicists and reactor engineers concerned with the reliability of data and calculation methods. The authors are to be congratulated on having adeptly encapsulated a large and rapidly changing subject within the covers of a single book.

Dr. Raymond L. Murray received his first degree in science education at the University of Nebraska, where he also received a masters degree in physics. His doctorate was from the University of Tennessee. In World War II, he contributed to the uranium isotope separation research and production at Berkeley and Oak Ridge. He has been a faculty member at North Carolina State University since 1950, assisting in the establishment of the first nuclear engineering curriculum and the first university nuclear reactor. He served as Burlington Professor of Physics, as head of the nuclear engineering department for 11 years, and currently is professor emeritus. He has published a number of research papers on reactor theory and design analysis, has written textbooks in nuclear engineering and basic physics, and serves as consultant to industry on reactor design and nuclear safety. He has been a member and chairman of the North Carolina Radiation Protection Commission. His current studies involve nuclear reactor analysis related to the Three Mile Island-2 recovery and to uranium resource extension, the application of microcomputers to nuclear problems, and public information on nuclear energy, especially radioactive waste management.

World Energy Supply

Author	Manfred Grathwohl
Publisher	Walter de Gruyter and Company, Hawthorne, New York (1982)
Pages	450
Price	$49.50
Reviewer	Efstathios E. Michaelides

Reading this book by Grathwohl has been a gratifying and rewarding experience. It is a complete treatise on the subject of energy, written with a rare combination of technical expertise and economic competence. Its pages contain a vast amount of information, valuable to the practicing engineer, the research scientist, and even to the nontechnical social scientist.

After a brief introduction, the book presents a short historic background and the basic principles for the conversion of energy (laws of thermodynamics). Then follows a presentation of the primary energy consumption in the world and its connection to national economic and population growths. Here some basic aspects of energy economics are also examined. The third chapter of the book is devoted to the potential of the world's primary energy sources. The sections cover conventional sources, such as coal, oil, and gas as well as more modern sources, such as fuels for nuclear fusion and fission, geothermal, solar, and tidal energy. The lengths of these sections are approximately proportional to the expected impact of the energy source on the world energy supply. The fourth chapter examines the technical aspects of the production of secondary energy forms. The production of electricity from nuclear fission or fusion is given in detail as well as heating from solar energy. Sections include methods for the production of electric power from the wind, waves, ocean currents, biomass photolysis, tides, and geothermal resources. The direct methods for energy conversion (magnetohydrodynamics, thermoelectrics, thermionics, fuel cells, and radionuclides) are also discussed. A lengthy exposition follows on the technical and economic aspects of coal gasification and hydrogen energy. The fifth chapter of this book discusses the environmental and safety considerations of energy production and transportation. The topics covered include the safety of nuclear installations and the waste problem, the environmental impact of new energy sources, the emissions of pollutants, and the climatic changes associated with the release of carbon dioxide and waste heat.

The number of references (close to 800) is an asset for this book. Thus, the interested reader can improve his knowledge of a specific subject by looking at the relevant references. The exposition is complete with lists of abbreviations, units conversion table, and a text of the nuclear proliferation treaty.

The author approaches the subject of energy in a global rather than topical way. Because of this, his book will be of interest to the engineer and the researcher. In general, the book is very accurate and rigorous, although there are occasional mistakes in the translation of certain technical terms from German. The originality of the book lies in the fact that the author has compiled information from diverse fields to produce a unified approach to the solution of the energy problem.

Efstathios E. Michaelides was born in Thessaloniki, Greece, and studied at the University of Oxford, England (BA, engineering science and economics, 1977) and Brown University (MS, 1979, and PhD, 1980, engineering science). Since the summer of 1980, he has been an assistant professor at the University of Delaware in the Department of Mechanical and Aerospace Engineering. His research interests are multiphase flow, energy conversion, geothermal energy applications, and irreversible thermodynamics. He has contributed about 40 papers to scientific and technical literature.

Advances in Non-Destructive Examination for Structural Integrity

Editor	R. W. Nichols
Publisher	Elsevier Science Publishing Co., Inc. (1983)
Pages	447
Price	$90.25
Reviewer	Gerald A. Schlapper

This book is a compilation of papers from the Second International Seminar on Non-Destructive Examination in Relation to Structural Integrity held in Paris, France, during August 1981. The papers presented deal with the nondestructive examination of steel welds in relation to assessment of

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