BOOK REVIEWS

Selection of books for review is based on the editor's opinions regarding possible reader interest and on the availability of the book to the editor. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

Transient Phenomena in Multiphase Flow

Editor N. H. Afgan

Publisher Hemisphere Publishing Corporation (1988)

Pages 1052

Price $195.00

Reviewer Milton S. Plesset

Three years ago, the International Center for Heat and Mass Transfer organized a symposium on transient phenomena in multiphase flow. Over 50 papers were presented at the symposium, which had worldwide participation. The papers were divided into the following categories: formulation of two-phase flow, turbulence phenomena in two-phase flow, wave phenomena in two-phase flow, modeling of transient two-phase flow, numerical methods of two-phase flow, and experimental studies.

Some papers do not fit into these categories very well, as might be expected. There was certainly a great variety of papers presented. The widespread nature of the topics and of the participation is remarkable. Questions naturally arise as to what has led to this growth of both the topic and the number of participants.

The very modest beginning of two-phase flow studies can be traced back to the work of Cook and Rayleigh, who were concerned with cavitation damage and noise. Rayleigh assumed that the phenomena were directly related to the formation and collapse of a single bubble. This kind of work continued at a very modest level until recently. Concerns about nuclear power plant safety has led to many experimental programs and related analyses of the results.

The U.S. Nuclear Regulatory Commission (NRC) has made large expenditures for both tests and analyses, which were justified because of the many questions regarding public safety. The experimental tests were far from trivial because of the scale of nuclear power plants, and the analyses led to very elaborate and complicated programs. The continued questions about these tests and their interpretations finally led to an NRC study regarding code scaling, applicability, and uncertainty (CSAU), under the guidance of Novak Zuber. The Advisory Committee on Reactor Safeguards (ACRS) stated that "the CSAU Program will provide a reasoned perspective on the accuracy of the existing codes ... The CSAU method, or something similar, can be used in other areas of safety analysis, that is, beyond the currently conceived purpose of assessing uncertainty associated with calculations by thermal-hydraulic codes. In particular, its application to severe accident studies and risk assessments could serve not only to provide an improved perspective on uncertainty, but also as a guide to allocation of research resources."

In December 1989, NUREG CR 5249, entitled "Quantifying Reactor Safety Margins," was issued. It gives a most reasonable summary of these very important questions. The report also contains a calculation for which Dr. Catton is responsible, which is called a physically based method of estimating pressurized water reactor large break loss-of-coolant accident peak cladding temperature. This analysis gives another reassurance regarding the large codes. It is unfortunate that the symposium was over before this work was completed. Perhaps there will be another symposium, and Zuber and Catton will be able to present results of their studies.

The symposium covered a wide range of topics and the large number of speakers indicates the many countries that have supported research in the field. The organizers of the conference should be complimented for their successful effort in leaving very few gaps in this diverse subject. The editor and publisher also deserve compliments for this well-organized volume.

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The Demise of Nuclear Energy?

Authors J. G. Morone and E. J. Woodhouse

Publisher Yale University Press (1990)

Pages 156

Price $22.50

Reviewer Bernard I. Spinrad

The tone of this book is mildly pronuclear. The authors seem to want nuclear power to emerge again. This is a welcome event in the history of scholarly critiques of nuclear power and is in itself a recommendation to nuclear advocates

to take what this book says seriously, even though some of the thoughts presented will seem to be heresy to the typical nuclear industrialist.

This is a slim book, only 156 pages, but it manages to pack a lot of punch. It addresses the questions of how nuclear energy developed, how public opinion turned against it, and how the utility industry finally gave up on it. It closes with a suggestion as to how a second nuclear era might be structured.

The history section describes the origin of the light water reactor (LWR), how it won out over competitive designs, the decision to privatize the nuclear industry, and the triumph of accident prevention over accident mitigation as the primary safety strategy of the fledgling nuclear power industry. It continues with the rapid scaleup of unit size during the late 1960s and the debacles that followed.

In the interpretive section, the book offers several points about the collapse of both public and utility faith in atomic energy, including the difficulty of demonstrating accident prevention, the public distrust of pre-1968 institutions, and the effects of Three Mile Island and Chernobyl. It then discusses major *paths not taken*: choosing a reactor system other than the LWR, emphasizing inherent safety as a reactor design requirement from the beginning, perfecting earlier models in smaller unit sizes before scaling up, and even the possibility of making nuclear power a federal monopoly once again, as it was under the original Atomic Energy Act. It concludes with observations, not recipes, on possible actions that could make a second nuclear era happen.

Some of the history struck me as shallow. The book accepts too uncritically the influence of the navy program on the civilian one, thus downplaying the crucial and independent roles of the national laboratories and nuclear vendors in the developmental process. It also gives insufficient attention to the 1962 Report to the President. This report created a sense of panic both on the Congressional Joint Committee on Atomic Energy and in the fledgling nuclear industry. It seemed to say that there was no time to look at alternatives and that the growth rate of nuclear power would be so spectacular that targets could not be met if small reactors were built deliberately. As a result, the nuclear enterprise was turned over to a bureaucracy, composed mostly of people with naval reactor backgrounds, whose specific assignment was to encourage rapid deployment of nuclear power. Accident prevention, without any attention to accident mitigation, was a standard navy practice that became inherent in regulatory philosophy. Regulation by prescriptive design rather than by functional performance was another. Indeed, attitudes such as a still-visible prejudice against automation came from the navy and continue to hamper the attempt to make reactors safer.

But, when all is said and done, the suggestion that nuclear power generation be refederalized was the one that tugged the strings of my memory. As an avowed New Deal enthusiast, I recall how hopeful I was in 1946 that nuclear power would be the instrument for federalization of the vital electricity generation industry. The fights over the Tennessee Valley Authority were a very real part of my political education, and scandals in the private utility industry were still remembered. When nuclear power was defederalized in the 1950s, it became a symbol of big business clout. Liberals became disenchanted with it except for those, such as I, who were intimately associated with its progress. When the time for liberal resurgence arose in the late 1960s, that chicken came home to roost. Perhaps there is a lesson to be learned from France, which is a democratic country with a socialist utility system and has the most successful nuclear program in the world.

I advise the readers of this journal to read this book and be stimulated by it.

Bernard I. Spinrad (PhD, chemistry, Yale University, 1945) has worked continuously on nuclear energy since 1946, at Oak Ridge and Argonne National Laboratories, the International Atomic Energy Agency, Oregon State University, and Iowa State University. His early work on reactor physics and computation methods made him a leader in reactor design physics. He has broadened his interests in academe and is now known as a nuclear generalist, with research on nuclear safeguards, the nuclear fuel cycle, economics of nuclear power and reactor safety, as well as research and power reactor design and reactor physics.