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.

Thermohydraulics of Two-Phase Systems for Industrial Design and Nuclear Engineering

Author	J. M. Delhaye, M. Giot, and M. L. Riethmuller
Publisher	Hemisphere Publishing Corporation, Washington D.C. (1981)
Pages	526
Price	$39.50
Reviewer	Varada Charyulu

During the 1970s much of the information pertaining to thermohydraulics of two-phase flow was available from the proceedings of the several international conferences held on related subjects, from lecture notes delivered to limited attendees at various international institutes, or from research reports that are not always easily accessible. However, not until the 1980s has there been a systematic attempt to gather all this scattered information and formulate it into a series of coherent, consistent, and comprehensive reference books that could benefit the practicing engineer in the design of various industrial processes. This book is a result of such an effort by six well-recognized specialists in the field.

The first two chapters set the stage for the book. In the first chapter, Hsu discusses in a concise manner the two-phase flow problems in pressurized water reactors (PWRs). This is followed by a similar chapter by Costa on liquid-metal fast breeder reactors (LMFBRs) in which differences in the nature of the two-phase flow problems in LMFBRs and PWRs are clearly drawn.

The next chapter by Delhaye on two-phase flow patterns collects flow maps and relations that tend to predict flow patterns in gas-liquid flows in pipes. Most of the information is available from other sources, and the latest available information relative to the date of publication has not been included. The following chapter on instrumentation is a summary of the vast amount of experimental work on flow instrumentation. This chapter, while not exhaustive on the subject, does serve the twofold important purpose: the need for and the difficulties associated with experimental data in the understanding and applications of two-phase flows. Over all, these two chapters provide the necessary background and information on the subject.

The next five chapters (Chaps. 5 through 9) are devoted to theoretical formulations of two-phase flow equations. Except for the chapter on interfacial equilibrium and nucleation by Giot, in which relations pertaining to the basic phenomena are derived in simple situations, all the other chapters are contributed by Delhaye. While he has been actively involved in developing a theoretical basis for the two-phase flow for quite some time, information from these chapters does not seem to be directly applicable to industrial design. Albeit, they do provide the necessary sound theoretical foundation on the subject.

The next chapter, also by Delhaye, is on flow modeling in which an attempt is made to examine the various models. A way to reduce the complexity associated with the two fluid model is also included.

In Chaps. 11, 13, and 18, Giot has given an excellent review on friction factors, pressure drops, and critical flow. The relevance and importance of these topics in industrial design have been well presented in these chapters. Pressure drops in rod bundles are dealt with in Chap. 12 by Grand, who has brought forth clearly the associated problems and the need for further work. It is surprising that very little new work has been reported on this subject since 1973-1974! A sound theoretical basis for critical flow with a review of experiments and facilities and comparison of experimental results with calculations is the subject of Chap. 18. Heat transfer with change is discussed in two separate chapters by Hsu. In Chap. 14, Hsu evaluates the state of knowledge in heat transfer correlations during boiling and their role in developing the "best estimate (BE)" model. Sensitivities, range of validity, recommended correlations and their data bases together with special features pertinent to blowdown and reflood stages are discussed. In the chapter on condensation heat transfer, a set of equations is recommended on a tentative basis as sufficient information is lacking for the reactor safety application. Hsu has identified the need for in-core measurements, a validated data base, and improved modeling in these areas so that a high level of confidence in reactor safety analyses can be achieved.

Discussion of regime transitions in boiling heat transfer and instabilities and propagation phenomena in two-phase flows is in Chaps. 16 and 17, respectively; both are by Yadigaroglu. Models of regime transitions and correlations that are current for predicting these transitions as well as the physics of the transition phenomenon are covered in Chap. 16. In Chap. 17 various types of instabilities are reviewed and specific stability topics of interest to the nuclear field are treated. Some areas of concern to the nuclear industry are identifed. In these two chapters the subject matter pertaining to boiling water reactors is also treated. The general impression is that there exists a need for analysis, numerical modeling, and experimental verification in these two areas.

The last two chapters are applications of the information presented in the previous chapters and show how one might use this knowledge to solve complex problems in nuclear engineering. The chapter on codes and two-phase flow heat transfer calculations, in which RELAR-4 and TRAC are considered as examples of codes for thermohydraulic calculations, is by Hsu. Applications to LMFBRs with SIMMER code as an example is written by Grand.

Although there has been some additional information available since 1978, the date of formulation of this book, this book fills a long-awaited need, especially for the advanced graduate student and for the practicing nonspecialist in the field of nuclear engineering. Although the title suggests that it is meant for nonnuclear disciplines, the emphasis and philosophy are heavily biased toward nuclear applications. Of course an interested nonnuclear reader will still find use for this book as quite a bit of the book is directed toward understanding the general mysteries of two-phase flow. It was a delight to review this book.

Varada Charyulu is a professor in the School of Engineering at Idaho State University. He has had varied experience and interests. His main areas of research are in fast reactor safety and physics. Recently he was at Kernforschungszentrum-Karlsruhe in the Federal Republic of Germany on sabbatical leave where he did some work on two-phase flow and fast reactor safety. He has been a consultant to energy conservation firms and has been active in promoting conservation energy programs.

The Energy Crisis, Conservation and Solar

Authors	Harvey Rose and Amy Pinkerton
Publisher	Butterworths, Woburn, Massachusetts (1981)
Pages	203
Price	$14.95
Reviewer	Varada Charyulu

Conservation and solar are two important and noble topics; throw in the phrase "energy crisis" and you have a pretty catchy title for a book. According to Denis Hayes, Director of Solar Energy Research Institute, who wrote the Foreword to the book, the authors

> . . . have shown us how to conserve energy while enhancing our lifestyles. They have demonstrated how to reduce further our foreign oil bill and how to put solar energy to work for us. They have given us a vision of a better, more equitable and more resilient society into which the United States could evolve. *The Energy Crisis, Conservation and Solar* points the way toward a stable, sustainable energy future.

From the title and the Foreword, it would be natural for the reader to expect substantial information on these topics from the book.

This book is in two sections. The first section deals with energy conservation while the second section is concerned with solar energy. There is no third section; the authors seem to have forgotten about the very first topic of the title of the book! The energy crisis is not discussed at all in the book! Perhaps, according to the authors, there exists no energy crisis.

Each section has a brief introduction followed by five chapters. At the end of the two sections there is a special chapter on conclusions. The five topics considered in the first section are: conservation in buildings, conservation in industry, cogeneration, recycling, and transportation. Chapter titles under the section on Solar Energy are: "Passive Solar Energy," "Active Solar Energy," "Photovoltaic Cells," "Wind Energy," "Alcohol Fuels," and "Biomass Energy." It is surprising that the last two topics are considered to be solar energy forms while energy from the tides, ocean thermal gradients, coal, and nuclear fuels, and other solar-originated energy forms have been excluded! After all, aren't the earth's resources the results of solar phenomena?

Reading through, one finds that there are hardly any new or substantive ideas in the book. Most of these topics have already been reported several times in newspapers, television or radio broadcasts, or popular magazines. In fact, a majority of references cited in the book are from the news media. Each chapter includes a section that relates to policy aspects in some form or other. These policy recommendations advocate some sort of legislation that results in either taxation to promote the authors' ideas, gives incentives in the form of tax rebates, or curtails individual freedom in some form. Some of their recommendations have already been implemented either at the federal or state level, and many of us have realized the fruits of these legislations!

One nice thing about the book is the style. It is very casual, and so it is easy to read. However, many times it is very hard to understand or follow the logic of the authors. For example, consider the very first paragraph from the chapter on cogeneration. To quote the paragraph (the numbers in the parentheses refer to the authors' references in the text):

> There is an energy-saving opportunity in U.S. industry that requires no technical breakthroughs, lifestyle changes or economic sacrifice; could supply more than enough electricity for all U.S. industries (1); and could save as much oil as the Alaskan North Slope will produce (2). Yet most people have not even heard of cogeneration, although it was used by 56% of U.S. industries in the 1930s (3), and may become our major new source of electricity in the next 10-15 years (4).

Is this form of energy advocated for the industrial sector or is it implied that "common people" should be using cogenerated energy? Are industries unaware of cogeneration? Why has it not been popular with the industrial sector? Doesn't the industrial customer have to make some "sacrifices?" Since this form of energy does not directly affect most of the public, it makes no impact on us except perhaps to point out how uninformed or reluctant or unconcerned the utilities are!

This book is beset with such loosely written statements, which, when closely examined, lead to meaningless conclusions. The general theme of the book is that conservation and solar energy reduce dependence on foreign oil and goods. However, it advocates the use of heat exchangers made by Mitsubishi Electric Corporation!

In several places the book refers to "dangerous forms of energy" either directly meaning nuclear or implying it but