Freezing and Melting Heat-Transfer Problems (Fukusako and Seki)

Chapter 8. Complex Heat Transfer Processes in Heat-Generating Horizontal Fluid Layers (Cheung and Chawla)

The chapters vary widely in quality: chapters 1, 4, 6, 7 deserve A's; chapter 5, a C; chapter 8, an F; and the remaining chapters, B's. Perhaps the editor should have paid more attention to quality control. This volume lacks depth because a single editor tried to cover a broad range of topics: from radiative heat transfer to algorithms for parabolic equations. Also, readers would have been better served if the authors focused on producing a critical guide to published literature instead of giving a detailed exposition of material. The style varies from that of a textbook to that of a research paper. For example, in chapter 3 (group explicit methods) the author even presents details of stability analyses for the algorithms he is reviewing (or proposing). This leaves the reader uncertain as to whether the material has been critically refereed elsewhere.

Chapter 8 (convection in layers with internal heating) contains slabs of detailed exposition (e.g. 3.1, 3.2) more appropriate to a text. This chapter presents the relation between thermal boundary-layer thickness and Nusselt number $\delta \sim Nu^{-1}$ as a theoretical result supported by experiment, rather than as a consequence of the definition of Nu. It contains other gems, but this tells you its caliber.

It is unfortunate that the quality is so spotty. The authors of chapters 1, 4, 6, 7 have been betrayed by the editor. The volume is expensive for only four good reviews. It does not approach the quality of *Advances in Heat Transfer or Annual Reviews in Fluid Mechanics*. I do not recommend it either for browsing by graduate students, or for purchase by libraries.

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Mixing: Theory and Practice, Vol. III

By V. W. Uhl and J. B. Gray, Eds., Academic Press, Orlando, FL., 1986, $89.50

This text is the third volume in a series. The first two volumes were published in 1966. Mixing research has changed since then, and a significant amount of work has been accomplished that challenges authors in the area. The chapters in Volume III cover: 1) agitation of solid-liquid mixtures, 2) turbulent mixing in pipes, 3) flow fields produced in tanks by axial flow impellers, 4) scale-up, and 5) mixing of solids. Accordingly, the text emphasizes the physical aspects of mixing.

Gray and Oldshue are the authors of the first chapter. The chapter covers a broad range of the important aspects of solid-liquid mixing. The chapter is well organized. References are cited often, permitting the reader the oppportunity for further study. References include important work done in Europe. Mass transfer and the effects of tank and particle geometrics on solid-liquid mixing are discussed. This chapter warrants close study.

Much the same can be said about the second chapter on turbulent pipe-mixing by Gray. Japanese literature is also cited in the second chapter. It is important to note that Joe Gray was the senior mixing consultant for E.I. DuPont de Nemours and Co., Inc. for a number of years. His experience and knowledge are demonstrated in these chapters.

In the third chapter of Volume III by Fort, the author claims 'to completely describe the velocity of axial impellers in baffled tanks." Unfortunately, he does not accomplish this task (see Smith, 1985), nor does he explain the need for such detailed information about flow fields in the first place. In essence, the chapter is a summary of the author's work. There are 51 references cited; 40% are by the author, ten are general reference texts and the remaining twenty references are primarily from the Czech mixing community. The chapter does not contain a definitive study of flow fields produced by axial flow impellers.

The chapter on scale-up by Uhl and Von Essen is a fairly complete discussion of standard scale-up techniques for agitated tanks. Scale-up of other mixing devices, such as static mixers, is not presented. Practical advice, methodology, and example problems are given, apparently summarized from the literature. The chapter is at the introductory/intermediate level and is a worthy study for the design engineer.

Negative aspects of the chapter include a wordy writing style and citing of specific references is limited. The work does not emphasize testing for actual process performance after scale-up, which is obviously very important. The origins of the various scale-up procedures are not given, and statements concerning the inability to apply the various equations of motion to mixing are not correct (see for example: Hiraoka et al. 1979, Kuriyama et al. 1982, and Middleton et al. 1984). Advances in scale-up methods will be based upon computational fluid dynamics in the coming years. Such work is well developed at the present time.

Chapter 5, by Williams, concerns the mixing of solids. This chapter is well-written and serves well as an introduction, covering a breadth of information including statistics of mixing indices, solids segregation, mixer selection, testing, continuous solids mixing and mixing of cohesive solids. There is also discussion of research needs.

The editors promised in the preface to provide a "combination of in-depth scrutiny and reduction to practice." The text fulfills this objective with few exceptions. The volume, overall, is a very fine professional level text which is in the tradition of the first two volumes in this series.

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First-Order Partial Differential Equations: Volume I Theory and Application of Single Equations

By Hyun-Ku Rhee, Rutherford Aris, and Neal R. Amundson, Prentice-Hall, Englewood Cliffs, New Jersey, 543 pp. 1986

This book is the first of two volumes in a major revision of *Mathematical Methods in Chemical Engineering: Volume 2 First-Order Partial Differential Equations with Applications* by Aris and