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.

S. Morris
Dept. of
Mechanical Engineering
University of California
Berkeley, CA 94720

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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G. Tatterson
Texas A&M University
College Station, TX 77843

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

Amundson. The earlier version appeared in 1973 and is out of print. In the revision, Volume I covers single equations, while Volume II will cover systems of coupled equations.

First-order partial differential equations arise in chemical engineering largely as convective conservation laws. The principal applications in the book are chromatography and adsorption processes. Additional applications include heat exchange, pool boiling, chemical kinetics, reaction engineering, water flooding of petroleum reservoirs, propagation of sound waves, and sedimentation. A substantial amount of material has been added in revision on countercurrent adsorption in moving beds and traffic flow.

Volume I covers material presented in the first seven out of nine chapters of the earlier version; originally, 267 pages, now the treatment has been expanded to roughly twice that number. The presentation has been considerably reorganized. While little of the earlier version has been left out, the material added is nicely balanced between broad treatment of applications and thorough explanations of theory. The expanded treatment in the central chapters in particular is an improvement over the previous version.

The approach adopted in the book is to classify equations by type and present methods appropriate for the solution of the various types. The coverage is comprehensive. Especially detailed treatment is given of the homogeneous quasilinear equation with considerable discussion of simple waves and the formation and propagation of shocks.

In the preface, the authors express their hope that the book will be used in applied mathematics course offerings for first-year graduate students. Indeed it should be for several reasons. The subject is an important one. The book contains a number of exercises, many of which were added to the revision. Throughout the book, particularly, the early and central chapters where the main ideas are presented, the treatment is easy to follow. The authors tie together engineering literature and more formal mathematical literature. Referencing is thorough and up-to-date. For many of these same reasons the authors deserve the thanks of researchers active in the areas of application.

M. D. LeVan
Department of Chemical Engineering
University of Virginia
Charlottesville, VA 22901

Plastics Technology Handbook

By M. Chanda, and S. K. Roy, Marcel Dekker Inc., New York, NY, 568 pp., 1987, $99.75.

This book is divided into the following four sections and contains six appendices.

Section 1: Characteristics of Polymers. It deals with their definitions and concepts.

Section 2: Fabrication processes. Discussed in this section are the major polymer conversion processes.

Section 3: Plastics Properties and Testing. Various properties and the testing methods of plastics are described.

Section 4: Industrial polymers. This main section is divided in three parts to focus on the chemical structure, synthesis, and typical applications.

1. Addition Polymers: polyolefins, olefin copolymers, acrylics, vinyl polymers
2. Condensation Polymers: polyesters, polyamides, formaldehyde resins, polyurethanes, ether polymers, cellulosic polymers
3. Special Polymers: heat resistant polymers, silicones and other inorganic polymers, functional polymers

In light of the increasing trend of new books toward specialization and theoretical aspects of polymer science and engineering in recent years, it is comforting to see a book which is broad in contents and basic in level of treatment.

As the press release by the publishers states, this book could be appealing to various readers—from plastics, mechanical and chemical engineers, to colloid, oil and color chemists, as well as materials scientists and students (both undergraduates and graduates) taking courses in plastics and polymers. Many will find the section dealing with electrical and optical properties quite valuable, while others will find the treatment of the micromechanics of reinforced plastics well structured and educational. The main section describing industrial polymers contains a wide range of useful information on new polymers, particularly the specialty polymers. Extremely useful for those involved in selection and use of polymers is Appendix 1 which lists trade names and manufacturers for polymers available commercially, and Appendix II which lists typical properties.

There are, however, a number of shortcomings varying from superficialities and inconsistencies to fundamental inadequacies. While one may tolerate the "minestrone" approach to the use of units for polymer properties and processing parameters, there can be no excuse for dismissing "extruder capacity" with a half page treatment which includes two unfamiliar and simplistic empirical equations. Very little attention has been given to additives, and plasticisers are discussed primarily in terms of solubility parameters and what characteristics they should possess, without discussing how they affect properties.

Leno Mascia
Institute of Polymer Technology
and Materials Engineering
Loughborough University of Technology
Loughborough LE11 3TU, England

High Resolution NMR Spectroscopy of Synthetic Polymers in Bulk

By Richard A. Komoroski, Ed., VCH Publishers, Inc., Deerfield Beach, FL, 379 pp., 1986, $75.00

The past twenty years have witnessed the development of techniques for high-resolution nuclear magnetic resonance spectroscopy of rigid solids. This book is the first dedicated compendium of applications of these techniques to synthetic polymers. The book is intended to serve both as a summary of work published to date and as a guide for further research. It was written primarily for polymer scientists who have some familiarity with NMR and an interest in applying high-resolution techniques to bulk systems. For such an audience, most of the book should be readily understandable. The text is organized by topics in polymer science, which emphasizes the wide range of applicability of the techniques to this field. Mathematical justification for the spectroscopic methods is limited. Instead, specific examples drawn from the polymer literature are presented and discussed in detail.

The first chapter of the book provides an overview of potential applications of high-resolution NMR methods to solid polymers, introducing many of the topics to be dealt with later and mentioning other areas such as imaging, bipolymers, and surfaces. Chapter 2 summarizes the line-narrowing and sensitivity-enhancement techniques used for recording high-resolution spectra of dilute spins in solids. These include magic-angle spinning, high-power decoupling, and cross polarization. The next three chapters deal with applications of these methods to glassy