BOOKS

Diffusional Mass Transfer, A. H. P. Skelland, Wiley, New York (1974). 510 pages. $24.95.

The dominant theme in this book is the discussion and review of a representative selection of topics in the theory and practice of diffusional and convective mass transfer. Emphasis is placed on clear presentation of the derivation of important relationships and exemplification of their uses in solving a variety of practical problems. Topics and materials are selected so as to familiarize the reader with the fundamental concepts and equations of mass transfer, empirical correlations, useful mathematical techniques, and the principles and procedures of column design. The mathematical treatment of the subjects is generally made on the undergraduate level without using vector or tensor notations.

The book begins with a chapter containing introductory remarks on the nature and diversity of mass transfer processes which occur frequently in chemical, biological, and engineering practice. In Chapter 2, different ways of defining mass fluxes are presented. Mathematical solutions are then shown for typical steady and unsteady state molecular diffusions in stationary media. Chapter 3 discusses and contains a collection of various theoretical expressions and empirical correlations currently available for estimating molecular diffusivities in gas mixtures or liquid solutions.

The concepts of individual and overall mass transfer coefficients are introduced in Chapter 4, followed by a brief review of the existing theories on the mechanism of interfacial mass transfer. The topic of mass transfer in laminar or turbulent flow is treated in considerable detail in Chapters 5 and 6. The analysis covers both internal and external flows, including those with high mass fluxes where the velocity field is significantly affected by the high rate of mass transfer.

The final three chapters, Chapters 7, 8, and 9, are devoted to industrial column designs. Chapter 7 discusses the principles of continuous column design using the conception of NTU (number of transfer units) and HTU (height of a transfer unit). The materials presented in Chapter 8 are chosen largely based on the author's own approach (co-authored with A. R. H. Cornish) for designing perforated extraction columns. The subject of simultaneous heat and mass transfer is taken up in the final chapter, where the rate equations are applied to the design of cooling towers.

Throughout the book, brief literature surveys are often given in conjunction with discussions. The surveys, however, are not always complete and up to date. For example, the analysis of mass transfer in laminar flow through a circular tube follows the mathematical procedure published in the 1930's, although simpler and more precise ways of determining the eigenconstants for this problem have appeared in the literature during the past several years. It should also be pointed out that the book contains virtually no theoretical treatment on the important subject of mass transfer in a chemically reacting system or that of diffusions in multicomponent systems.

Apart from these shortcomings, the book is well written and organized. It would serve as a good introductory text for engineering students and a general reference book for practicing chemical and mechanical engineers.

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The Elements of Chemical Kinetics and Reactor Calculations: A Self-Paced Approach, H. Scott Fogler, Prentice-Hall, Englewood Cliffs, N. J. (1974). 497 pages. $21.00.

Customarily in the teaching of chemical engineering courses, a significant portion of classroom time is utilized in transferring information from the course text to the chalkboard by the instructor and from chalkboard to notebooks by the students. This book by Fogler provides the basis for an alternate approach to the teaching (or learning) of chemical reaction engineering at the introductory level. The approach is a self-paced or programmed-learning one in which basic concepts are disseminated entirely through student readings from the book—readings which require the student to answer questions and derive, manipulate, or solve equations by actually filling in blanks as he reads the text. The instructor's role then, as taken on by Fogler himself at the University of Michigan, and by a number of others who have class-tested this text, is to conduct recitation-problem sessions and to meet with the students individually, or in very small groups, in informal conferences to discuss the material.

I used a preliminary edition of this text in a two-semester-hour senior course and found that all of the material in the ten chapters of the book could be covered in a two-semester-hour course. The credit, however, can easily be extended to three hours by making use of some of the open-ended guided-design problems which are given in an appendix. According to responses on questionnaires, most of the 66 students who took the course in two semesters regarded Fogler's book favorably. The most common complaint was that clarity was frequently lacking in text material as well as in the problems at the end of the chapters.

In my opinion, the book is generally well composed for self-paced instruction. The prose, not written in the usual terse style of textbooks, is very readable. The organization and perspective of the book are enhanced nicely by a topical flow chart shown in an introductory section and by duplication of the appropriate portions of that chart at the beginning of each chapter. Another very helpful feature is a succinct yet comprehensive listing at the end of each chapter of the essential topics covered and equations developed in that chapter. The text, assembled in a ring binder with soft covers, has a workbook appearance. Blank spaces (frames) are provided for answering the questions posed and for completing the exercises suggested. The text material is printed on just one side of a page with the solutions for the frames given on the back side.

Most of the topics usually covered in the first course on chemical reaction engineering are contained in this book, but unlike most others, it does not begin with a treatment of basic chemical kinetics and rate expressions. Instead, species material balances are first derived for a single reaction in batch, well-stirred, and plug-flow reactors. Then a number of elementary design problems are solved using graphical representations of rate-versus-conversion curves. Forms of the rate function are introduced in Chapter 3 when the student fully appreciates the need for an analytical rate expression in handling engineering applications.

Those using the text in course teaching will probably be annoyed by some of its shortcomings and some ambiguous or less-than-correct statements.

All-in-all, however, the book is a good one for a personalized or self-paced mode of instruction if the instruction is combined with discussion sessions which fill in some omissions and clarify some sources of confusion. The author states in the introduction that if this programmed text is utilized as suggested, it "encourages the reader to exercise a higher level of thinking" than would a standard or more conventionally-written book, and I tend to agree with him.

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First World Filtration Congress: Papers Presented (1974), Société de Chimie Industrielle, Halsted Press, Wiley, New York (1974). 295 pages. $32.50.

Of the 53 papers scheduled for the First World Congress, 49 are summarized in lengths ranging from 2 to 5 pages: 22 are in French. A veritable potpourri, the table of contents divides the material into the following six categories:

A. Bases theoriques, (12 papers); B. Automobile (6); C. Elimination dans les liquides (primarily deep beds) (6); D. Recuperation dans les liquides (rotary vacuum filtration, washing, deliquoring) (5); E. Filtration des gaz (9); and F. Osmose et ultrafiltration (10).

Le Groupe Filtration of the European Federation of Chemical Engineering struggled for two years to develop the First World Congress with the notable absence of cooperation of the Filtration Society which is based in England and draws half of its membership from the United States. Virtually all papers were accepted much in the style of AIChE national meetings. The short summaries vary widely in quality and frequently present only a portion of the delivered paper. This reviewer's own abstract is a weak substitute for his complete article presentation at the meeting.

In spite of weaknesses, the reader can obtain a sizable amount of information from the summaries. Of particular interest is the opportunity to see what problems are occupying Europeans, including a few from the Socialist countries. Unfortunately, and as usually happens, several papers from those countries never arrived.

It would be impossible to discuss all of the papers. Horvath (Hungary) touched on the relationship of high rates to hydraulic gradient in granular beds. Murkes (Sweden) shed little light on the difficult problem of scale-up of centrifuges. Fitzpatrick et al. (United States) competently discuss improvement in granular bed design. Difficulties attendant to degasification in beds during filtration was touched on by Leclerc et al. (France). From Italy (Fasoli et al.) came a treatment of radial deep-bed removal of oil in a moving bed filter. Sopher (United States) asserted that time between overhauls for interval combustion equipment could be tripled by improved air, fuel, and lubricating oil filtration.

Shirato (Japan) et al. examined power law behavior of filtration of non-Newtonian liquids. Zagrodzki (Poland) provided operating data for sugar filtration. Polyelectrolyles were the subject of the paper for Adin and Rebhun (Israel). They related jar tests to optimum dosage and studied the effect of bed depth or efficiency.

Claes et al. (Belgium) demonstrated confidence in fixed and moving beds for aerosol filtration. Stenhouse et al. (England) discussed theoretical and experimental studies of air filtration with resin impregnated wool filters. Loffler (Germany) described high-speed cinematographic techniques for obtaining particle trajectories and adhesion. Saravacus and Mitsoyannis (Greece) presented data on calcium salt fouling of reverse osmosis membranes.

The wide coverage and abbreviated summaries permits the reader to sample many fields quickly.

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Introduction to Process Economics, F. A. Holland, F. A. Watson, and J. K. Wilkinson, John Wiley, New York (1974). 290 pages. $17.50.

In general, this book is excellent. However, I feel the math may be too rigorous for many who have been out of school for more than a few years. More practical examples and possibly less theory would certainly make the material more interesting. The symbols and numbering of the equations are most confusing.

Some of the statements are not well defined in symbols and need the help of words. For instance, in the discussion of interest, $i' \leq i$ needs to be supported by saying "the nominal interest is less than or equal to the actual interest," or "you lose money when buying money if your effective interest computation makes it far different than the nominal interest." Bluntly, you do not get something for nothing, but watch out for the accountant with the fast pencil.

I do not see why Chapter 2, "Previous Methods for Calculating Capital Investment," is a separate entity. It contains the historical aspects of Chapter 1 and could have been combined with that chapter. Chapter 2 is even more superfluous because a better method in cash flow analysis is available. Chapters 3 through 8 are far more relevant.

Unfortunately, the book is too theoretical for many practicing engineers although they do need the information therein. It is better suited for the classroom or to a manager or accountant. Nevertheless, this book will join the others on my reference shelf because the content is useful; however it would be called upon more frequently if I didn't have to forage through quite so much theory to find the information I want.

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Advances in Preconcentration and Dehydration of Feeds, Arnold Spicer (Ed.), Halsted Press, New York (1974). 526 pages. $60.00.

One item that appears to be rising faster than the price of food is the price of books about food. I quickly decided I could not afford not to review this book comprising the proceedings of a symposium sponsored by the International Union of Food Science and Technology at Croydon, Surrey, England, in 1973.

The book brings together papers on new methods for preconcentration and dehydration of foods, an area of growing importance due to the increasing demand for convenience foods, and to the food processing needs of a world dealing with a food shortage. Since the book is "unit operations" oriented, it has applications for the chemical, oil, and drug industries.

The session on fundamentals provides a technical basis for compatibility of the remaining papers. Concentration processes are nicely unified by H.A.C. Thijssen's paper. The fundamentals of dehydration processes are well presented by M. Karel. The papers on essence recovery and rheological aspects of juice recovery are out of place in the fundamentals section. They fail to expand or build upon the base provided by the papers on concentration and dehydration. This letdown is typical of all sessions.

The second session, dealing with nonmembrane concentration methods contains another excellent paper by Thijssen, this one on freeze concentration. Due to the extensive literature on evaporation, Mannheim and Passy properly concentrate on equipment