BOOKS

Schaum's Outline of Theory and Problems of Thermodynamics, Michael M. Abbott and Hendrick C. Van Ness, McGraw-Hill, New York (1972). 346 pages. $4.95.

The fundamental principles of classical thermodynamics are presented in a clear concise fashion in this outline. By means of numerous examples and problems which are worked out in detail, the authors illustrate the applications of thermodynamics to problems of engineering interest. The book is restricted to the classical areas of thermodynamics, and no treatment of statistical concepts or irreversible thermodynamics is attempted.

The strength of the book lies in the detailed solutions to the examples and problems. One of the most effective instructional procedures for engineering students is to demonstrate how one works a particular problem and then to extend the technique to a general class of problems by assigning appropriate examples. Consequently, the book should be useful to undergraduates as a supplement to their text, to graduate students or practicing engineers who desire to refresh their knowledge of thermodynamics, and to educators in search of new problems or perhaps a different way of approaching a particular problem. With the 90 examples and the 150 problems for which detailed analyses are presented and 137 problems for which answers only are provided, the book can serve as a device for measuring one's progress in a self-study program.

The treatment is not of sufficient depth for me to use the book as the sole text in a classroom situation. Nonetheless the treatment of key topics of particular interest to chemical engineers (open systems, real gases, phase equilibria, and the fugacity concept) is adequate to permit the book to be used to supplement one of the better textbooks written with the chemist in mind (for example, Denbigh or Wall). Because of its orientation and the minimal treatments of power and refrigeration cycles, the book is probably of more interest to chemical engineers than to mechanical engineers.

While the book in general is quite well done, I found a few omissions somewhat disturbing. Since data from the steam tables are required as input in many of the problems, it would have been appropriate to include an abridged version of the tables as an appendix or else a Mollier diagram for steam which would have provided the necessary data. Similarly it would have been helpful if a corresponding states compressibility chart and fugacity coefficient chart had been included.

The book certainly is one with which all chemical engineering professors involved in teaching undergraduate thermodynamics should be familiar and it should find a much wider audience among those who like to learn by seeing how someone else tackles a particular problem.

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Staged Cascades in Chemical Processing, P. L. Thibaut Brian, Prentice-Hall, Englewood Cliffs, N. J. (1972). 275 pages.

The stated purpose of this text is to introduce the idea of staged cascades in chemical processing. Specifically it is intended to be used to expose students at the freshman or beginning sophomore level to professional type problems in chemical engineering.

The text begins by discussing the idea of cascades and some of the possible uses of cascade systems. The author bravely resists the use of the classic "halibut livers" problem and turns to a mudwashing problem instead. Single and multistage operations are analyzed for the mudwashing problem using steady state balances and a simple equilibrium expression. The Kremser equation is presented and the idea of optimum flow rates is introduced.

The subject then changes to liquid-liquid extraction. Single stage and multistage countercurrent extraction are discussed along with graphical techniques for solution. Multiple feeds, fractional extraction with reflux, unsymmetrical cascades, and solute buildup in a cascade are given prominent discussion. The final chapters treat our old favorites, binary and multicomponent distillation. Discussion of partial and total condensers, reflux ratios, feed condition and locations, products, enthalpy-concentration diagrams, vapor-liquid equilibrium, and most of the other popular quiz questions are included.

The book makes an interesting attempt at introducing this subject to freshmen and sophomores. It includes many example problems and some unsolved problems for study. Phase equilibrium is described phenomenologically and does not require a background in thermodynamics. Computer use is encouraged for problem solution but is not strongly emphasized. Economic considerations are introduced early, and the student should get some feel for the engineers role in the design process.

The material selected for the book is somewhat unusual in a text for beginning chemical engineers; about two-thirds of the book is devoted to distillation and all of its subtleties. Mudwashing and extraction are the only other operations treated here. The detail is such that the author's intent to study cascade systems gets lost. The student would get so involved with the details that he would lose sight of the real goals. Fewer side topics (that is, extraction reflux, multicomponent distillation, side products, partial condensers, etc.) and a broader overall goal would be most helpful.

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Education and Research in the Nuclear Fuel Cycle, David M. Elliott and Lynn E. Weaver (eds.), University of Oklahoma Press, Norman (1972). 334 pages. $9.95.

This book, consisting of 18 papers presented at the symposium at Norman in October, 1970, reviews the economics and characteristics of fuels used in present day reactors with projections for advanced breeder models. Although projected data are reported to agree quite well with fuel performance experienced in the first cycle in light water reactors, one wonders if the costs predicted by various study groups may be as much in error as the Bolsa Island desalting plant estimate of $440 million which became uneconomic when construction costs escalated to $765 million. Predictions of decreasing energy costs in designs progressing from the HTGR and the LMFBR fixed fuel reactors to molten salt fuel (MSBR) are attributed mostly to de-

creases in the projected fuel cycle costs. Hence, a need is cited for further optimization of reload operations, fuel type, shutdown, and power scheduling. Since these in turn depend on a better knowledge of materials behavior, burnup limits, and optimum fuel element design which must be established by experimental tests in a fast reactor, the total fuel cycle with recycle of plutonium or U^{233} is discussed at length.

In spite of the present inability to accurately model fuel cycle costs and performance, a three-fold increase to about 35,000 tons annually in uranium mining and milling is predicted for 1980. Future developments with some of the experimentation and manpower required are discussed in relation to fuel production, enrichment, separation of spent fuel, reactor design, safeguards, and regulation. The academic community is given the task of aiding in orienting management, labor, local government, and the public on the role of safeguards, in addition to conducting and evaluating research to keep safeguards technology abreast of a growing and sophisticated industry.

This collection of papers is an excellent review of the state of the industry and should be comprehensible to the average engineer; but for one not acquainted with the field, the acronyms employed without nomenclature listings make tedious reading and searching. The engineering and economic coverage of the problems encountered in the development of nuclear energy is stressed rather than reactor physics. The long lead times cited in the development of reactors and a proven fuel cycle show that advanced, economical breeder reactors are still in the future as an answer to the impending energy crisis. As an in-depth text for studying segments of the nuclear industry, this book would have little value, but it does give a good overall view of the technology which must be developed.

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Turbulence Phenomena, J. T. Davies, Academic Press, New York (1972). 412 pages. $19.50.

As an initial impression, this book is interesting, contains a great deal of valuable information, and makes a different and definite contribution to the popular (and perhaps overworked) field of transport phenomena. In fact, an alternate title might be "Transport Phenomena in Turbulent Systems."

The book has a rather wide range, touching on all the familiar transport topics and including several new ones. The first chapter introduces the basic concepts of turbulent flow such as types of turbulence, velocity distributions, friction factors, Prandtl's eddy mixing length theory, etc. The next several chapters use the Prandtl mixing length approach to develop logically the forms that correlations should take for heat, mass, and momentum transfer. Separate analyses are made of eddy transfer far from and near surfaces. Included are solid-fluid, clean gas-liquid, clean liquid-liquid, and film covered surfaces.

The final chapters in the book cover various special topics which reflect the author's background in surface phenomena. Interesting discussions of drag reduction, movement of individual drops (as influenced by surfactants), spontaneous emulsification, and dispersion of one phase in another are provided.

The single feature that makes this book unique is a complete absence of differential equations. None are presented and none are solved. The entire analysis is built on the eddy mixing length theory of Prandtl. The emphasis is on understanding the physical mechanism of turbulent flow and how this turbulence influences heat, mass, and momentum transfer.

Since many topics are discussed, the pace of the book tends to be rapid. Often the explanations are satisfactory and interesting. At other times they are not. In places the presentation of correlations becomes almost encyclopedic, making reading laborious. Sometimes topics are included without suitable amplification so that the final result is an incomplete and misleading picture of the subject. Unfortunately, the important topic of mass transfer with chemical reaction was a victim of this error.

The author and publisher suggest that the book is a suitable text for a first course in turbulence which is to be presented either at the undergraduate or graduate level. This is only partly true. The book is, for the most part, readable and the level is approximately correct for the upper level undergraduate or beginning graduate student. However, the introduction provided to some of the basic concepts is not satisfactory. The basic topics are covered too briefly and not entirely clearly; therefore, they would not provide an acceptable base for building the remainder of the course. Introduction to turbulence must come from some other source. This reviewer feels that the main value of the book is its alternate method of viewing turbulence phenomena. Hence, it would be satisfactory as a supplementary text and only if it were suitably supplemented would it serve as a primary text.

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Chemical Reaction Engineering, Octave Levenspiel, Wiley, New York (1972). 578 pages. $16.95.

Professor Levenspiel's second edition maintains the lucid style and clear exposition of the first which made it deservedly popular in teaching chemical engineering reaction kinetics. Although the organization of the book remains largely as before, it has been rewritten in a variety of ways, both small and large, and the reader will note considerable changes, especially in the second portion dealing with nonideal reactors and heterogeneous systems.

Texts in the general area of chemical reaction engineering vary greatly in the topics considered and their depth of coverage. The first half of this book provides an excellent detailed treatment of ideal reactors and, as in the first edition, extensively uses graphical means of explaining reactor performance both for clarifying concepts and for quantitatively comparing the performance of reactors under different constraints. The two chapters on nonideal flow and mixing provide a useful and a more extensive treatment of this area than that found in most books. Considerable attention is given to fluidized bed reactors, to fluid-fluid reactions, and to reactions between a solid particle and a fluid. Heterogeneous catalytic reactions are treated rather briefly as is fixed bed reactor design. Slurry reactors appear in passing, and there is no mention of trickle bed reactors.

One might also classify texts in this field in terms of their relative emphasis in approach on (1) clarifying concepts and providing insights, (2) developing rigorous mathematical treatments, and (3) giving guidance to practical applications, including useful correlations, data, and treatment of real situations. Professor Levenspiel's text seems to fall largely in the first category. The practitioner and the advanced student may profit from other texts which give more detailed guidance to the recent literature and more treatment of the complexities encountered in real reactors. However, the author states that he has set out to write an introductory