BOOKS

Principles of Unit Operations, 2nd Edition, A. S. Foust, L. A. Wenzel, C. W. Clump, L. Maus and L. B. Anderson, John Wiley & Sons, New York (1980). 768 pages. $31.95.

This second edition of a very complete text on the unit operations of chemical engineering follows, after a lapse of 20 years, the same pedagogical organization of the original edition. That is, equilibrium stage operations are treated firstly, followed by transport mechanism concepts.

Two new chapters have been added to this edition. The first of these (Chapter 8) is a welcome addition on the basics of multicomponent, multistage separations, covering both shortcut and rigorous, computer-oriented methods. The treatment of shortcut methods for distillation is somewhat disappointing, in that the reader is led to the Fenske equation but then left dangling with no mention of the Underwood equations, Gilliland correlation or other shortcut methods for determining minimum reflux ratio and actual number of theoretical plates required for a given separation. The second new chapter (11) is a presentation of equations of change. Given the rather high level of mathematical sophistication (vector calculus, substantial derivatives versus partial derivatives) required for understanding this material, however, one has to question the reasons for its incorporation in an undergraduate textbook.

Refreshingly, typographical errors are few and far between in this text. A minor irritation is the occasional appearance, particularly in the earlier chapters, of numerical quantities or results without their associated units. Also, in Chapter 9 there appears a confusing symbol (looks like /) for lower case L in various equations. This occurrence is even more confounding when one recognizes that the same physical quantity is denoted by the more common script character (ℓ) in the figures accompanying the text discussion.

A stated intention of the authors is the liberal incorporation of SI units into the various example problems and exercises at the ends of the chapters. This objective is generally achieved, although the extent of incorporation is highly variable (ranging from near zero in some chapters to around 50% in others). The example problems are generally well worked out in thorough fashion, and the variety of student exercises at the ends of the chapters is exceptionally good. As in the original edition, there is a large number of excellent photographs and drawings of process equipment.

There is a good collection of methods for estimation of transport properties of liquids and gases in Chapter 9. There is also an excellent coverage of heat exchanger design in Chapter 15, including heat exchanger simulation using the concepts of heat exchanger effectiveness and number of transfer units. The last chapter (22), together with the related Appendix B, has a very thorough coverage of particulate solids flow and separation. It is also heartening to see more than cursory mention of the unit operations of adsorption and ion exchange in Chapter 16.

This text is large, heavy and reasonably expensive ($31.95). Upon learning of the price, one of my colleagues (name withheld) observed that, on a per pound basis, the cost of this book is comparable to that of good bacon. In sum, this text should prove to be a more than adequate treatise on chemical engineering unit operations, particularly to those educators and readers of similar pedagogical persuasion.

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Computer Calculations for Multicomponent Vapor-Liquid and Liquid-Liquid Equilibria. J. M. Prausnitz, T. F. Anderson, E. A. Grens, C. A. Eckert, R. Hsieh and J. P. O'Connell, Prentice-Hall, Englewood Cliffs, New Jersey (1980), 353 pages, $24.95.

This book will be of interest primarily to process design engineers and computer applications groups who wish to implement a sophisticated and state-of-the-art computer program for the solution of vapor-liquid and liquid-liquid equilibrium calculations. The methods presented restrict application to nonelectrolytes at low-to-moderate pressures remote from the critical region.

The type of presentation given in this book is quite similar to that in the two earlier books by Prausnitz and co-workers (*Computer Calculations for Multicomponent Vapor-Liquid Equilibria*, Prausnitz, Eckert, Orye and O'Connell, 1967 and *Computer Calculations for High Pressure Vapor-Liquid Equilibria*, Prausnitz and Cheuh, 1968). The methods are thermodynamic and are presented in a succinct but clear fashion in the first chapters, with the major portion of the book being taken up by tables of parameters and detailed listings of the FORTRAN computer programs. The present book is intended to stand alone and is not an addendum to the 1967 monograph; rather, as the authors say, the previous book is "out-of-date" and the new monograph is a "major extension" since it discusses liquid-liquid equilibria and presents generalized iterative techniques for equilibrium calculations.

For researchers already immersed in the area and having similar computer programs there is little new in this book beyond what was published previously in the authors' papers. The material, however, is well organized and neatly packaged. The researcher may also find the discussion of computational efficiencies to be of interest. For the individual who is newly intent on implementing a computational scheme for phase equilibria, this book is an answer to his/her prayers. The selection of recommended methods most surely reflect the prejudices of the authors. If one were to select a group of scholars whose judgements he/she were willing to accede to in the area of phase equilibria, however, he/she would find it difficult to compose a better panel than represented by the authors of this monograph. For the vapor phase, the virial equation truncated after the second virial coefficient, with the Hayden-O'Connell method for estimating second virial coefficients in polar and associating systems, is used. For the liquid phase, the text discusses calculation of activity coefficients by the UNIQUAC model only. In the computer program listing, however, 13 different liquid phase models are included. Unfortunately, no discussion of the bases for selecting one model over the other or of their relative accuracies is given. Parameters are tabulated for 92 compounds.

There are a number of other strong points in this work. The use of symmetric or unsymmetric conventions for the liquid phase activity coefficients and the use of activity coefficients corrected to a constant reference pressure are clearly presented. The application of the calculation procedure to liquid-liquid systems is thoroughly discussed emphasizing the need for experimental mixture data in order to obtain reliable fitting parameters. The recommended method of parameter estimation is discussed and given in a computer program.

In summary, this is an excellent, up-to-date presentation of the UNIQUAC method of calculating vapor-liquid and liquid-liquid equilibria. It will remain of primary importance to workers in these areas until further research renders it obsolete. This obsolescence is quite likely to result from the efforts of the authors themselves.

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