BOOKS

Stability of Reaction and Transport Processes, Morton M. Denn. Prentice-Hall, Inc., Englewood Cliffs, N.J., 243 pages, $

This book deals with stability (Liapunov, linear and nonlinear) theory applied to chemical reactor and fluid systems (shear flow, buoyancy and Marangoni convection, and Couette flow), including extrusion and spinning instabilities of polymers.

In each case the author attractively presents the material by examining in detail a very simple mathematical model and then using an annotated bibliography to lead the reader into the literature. The leverage so obtained greatly expands the scope of the work. The detailed presentation does not give much in the way of physical insight into the problems but concentrates on the obtaining of a stability statement given the differential system of the model. The choices of references in the bibliographies are rather parochial, giving the reader the impression that all major contributions to stability theory have been made by chemical engineers. Perhaps the most glaring such case is the brief discussion in the good introductory chapter of the instability of a Newtonian fluid in the Couette flow between rotating cylinders. Here a figure is presented for the change in slope of the torque vs. shear rate curve due to the onset of Taylor vortices. The caption indicates an unpublished master's thesis from the University of Delaware!

There are several discussions that would be puzzling to the uninitiated reader. The (inviscid) Rayleigh criteria for centrifugal and shear flow instabilities are introduced by the statement that the limit of vanishing viscosity is a singular one, but the reader is given no guidance as to why the results should ever be useful.

Inexplicably, the discussion of Couette flow continually refers to the square of the azimuthal velocity divided by the radial position as the Coriolis acceleration. Perhaps those popular devices used in industrial separation should be called *ultracoriolifuges.*

"The student who has read the entire book should be prepared to solve problems and read the literature in linear and nonlinear stability for lumped and distributed parameters systems." I believe that this stated goal has not been fully accomplished. The subtleties of choosing appropriate idealizations for study, of scaling, and of relating these idealized results to practical problems have not been confronted. However, I do not think that these could be done justice in such a slim volume. The present book is a good one; a chemical engineer familiar with elementary differential equations, matrices, and Fourier series should come away from this book with an appreciation of why stability analyses are done and when in practical situations stability is an issue. He will also feel comfortable in reading the literature. He will probably need further help, though, if he wishes to be able to read the literature critically or to be a practitioner of stability theory or its applications.

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Turbulent Mixing in Nonreactive and Reactive Flows, S. N. B. Murthy, editor. Plenum Press, New York, 1975, 464 pages, $37.50

In 1974 Project Squid (U.S. Navy) and the Air Force Office of Scientific Research sponsored a workshop bearing the same title as this book. The workshop was attended by some eighty specialists from Europe and the United States. This volume contains the twenty-three papers presented there as well as the discussions following the papers. An unusual feature of the collection is a helpful subject index.

For a chemical reaction to proceed, the reacting species must be mixed at the molecular level, and for fast reactions the turbulent mixing rate rather than chemical kinetics controls the reaction rate. Turbulent mixing and its effect on reaction rate is the subject of this book. The papers, which are all by specialists in turbulence, emphasize modern turbulence theory and measurements. The book contains much food for thought both for "eddy chasers," who concern themselves with measurements of coherent structure in turbulence, and for the modelers of turbulence, who need an understanding of structure to proceed with mathematical modeling.

The first paper, by S.N.B. Murthy, is a comprehensive but concise (84 pages) review of turbulent mixing, and it is followed by a review paper on turbulence modeling (D.B. Spalding). Both are critical reviews, and both discuss unsolved as well as solved problems. Another paper (P.O.A.L. Davies) reviews an earlier conference on coherent structures in turbulence. The remainder of the papers are on specialized topics. Of greatest interest to chemical engineers are (1) a paper by C. duP. Donaldson in which the reaction A + B → C is studied for a variety of "eddy structures" and the results are compared to classical chemistry; (2) a computational study of the same reaction by R. Borghi; (3) a paper by E. E. O'Brien which is largely a review paper on the probability density function formulation of diffusion controlled reactions; and (4) a paper by P. A. Libby which contains a stimulating discussion and some experimental results on turbulent flows with fast reactions.

The book is an invaluable status report on a wide variety of topics included under turbulent mixing. The target audience, however, consists of turbulence buffs, and some prior knowledge of turbulence is required to take advantage of the wealth of ideas in the book.

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Equilibrium Properties of Fluid Mixtures (A Bibliography of Data on Fluids of Cryogenic Interest), M. J. Hiza, A. J. Kidnay, and R. C. Miller, Plenum Publishing Corporation, New York (1975), 160 pages, $29.50.

This volume is a part of the National Standard Reference Data System (NSRDS) Bibliographic Series. The authors are associated with the Cryogenics Division, Institute for Basic Standards, National Bureau of Standards. Approximately 1 000 reference citations (through 1974) are given for experimental phase equilibria and thermodynamic properties of the major fluid mixtures of cryogenic interest. The materials considered are hydrogen, hydrogen deuteride, helium, helium 3, (helium 4), deuterium, neon, carbon monoxide, nitrogen, oxygen, hydrogen sulfide, fluorine, argon, carbon dioxide, krypton, xenon, and the saturated and unsaturated hydrocarbons through the C_4's. A table of selected physical properties for the pure fluids is also included.

The bibliography is organized into ten sections each of which is independent of the other. Six sections are devoted to various types of phase equilibria. The remaining four sections are