plications, although it could be used and extended to other topics.

This course has evolved over the past 10 years and has taken on more and more of the practical application flavour as data become available and as examples of the application are worked out. At the present time the course is offered both as a graduate course and as a technical elective for seniors. We find that the attractive features of this course are the practical applications, the demonstrations that can be given in class to illustrate the behaviour, and the research films that have been developed to illustrate the behaviour. □

REVIEW: REACTOR DESIGN

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good qualitative discussion of the many problems related to reactor analysis and design.

The book is divided into two parts. The first part, containing six chapters, is on Chemical Engineering Kinetics. The second part has eight chapters, and deals with the Analysis and Design of Chemical Reactors.

In the kinetics part, the first chapter is on homogeneous reaction kinetics, while the second deals with kinetics of heterogeneous catalytic reactions. In Chapter 2, the treatment of how Langmuir-Hinshelwood Hougen-Watson rate equations are derived, given a reaction mechanism, is presented well. Both chapters also contain methods for kinetic parameter estimation, which are usually not found in most texts. Chapter 3 is the longest one in the first part, and it treats the interaction of transport processes with reaction kinetics in a single catalyst pellet—essentially the effectiveness factor problem. It is a good and thorough chapter. Chapter 4 has a good account of gas-solid noncatalytic reactions. Catalyst deactivation, by poisoning and coking, is treated in Chapter 5. Gas-liquid reactions are covered in Chapter 6, where both the film and surface renewal models are discussed.

The second part of the book starts out with a short Chapter 7 on transport equations for reactors. The next three chapters treat the batch, plug-flow, and stirred-tank reactors, respectively. Chapter 11, on fixed-bed reactors, is the longest (130 pages) in the book, and is indeed comprehensive. One and two-dimensional pseudohomogeneous and heterogeneous models are discussed in detail, and correlations to estimate transport parameters for these models are also given. Chapter 12 deals with non-ideal flow patterns, and also has a description of the more fundamental population balance models. Chapters 13 and 14 discuss the modeling of fluid-bed and multiphase reactors, respectively.

The collection of topics in the book is broader than in most other books available in the reaction engineering area, and this is a genuine strength. Nevertheless, there are omissions, some of which may also be cited. These include thermodynamics of chemical reactions (a weakness also in several other books in the area); experimental methods for measuring transport properties in pellets, and a comparison of measurements with predictions of several models that are discussed; metal catalyst deactivation by sintering. In a book of this type, it would have also been nice to see, at least for CSTRs, a more thorough treatment of steady state multiplicity for single and complex reactions, and of the complexities of transient behavior that are possible—but, of course, not everyone shares the same hobbies.

The preface suggests that the book can be used at both the undergraduate and graduate levels. However, in view of the general level and extent of treatment, I expect that it is appropriate and more likely to be used as a graduate text. Those engaged in practice will also find this to be a useful source of principles and design information, and with the extensive references provided, an excellent introduction to the research literature.

There are some 112 problems given at the end of chapters, and a solutions manual is available. □

SELECTED NUMERICAL METHODS AND COMPUTER PROGRAMS FOR CHEMICAL ENGINEERS

By Huan-Yang Chang, Ira Earl Over
Sterling Swift Publishing Co.
Manchara, Texas 78562

Reviewed by
Charles A. Walker
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Introductory courses in computer programming necessarily emphasize methods that are available for solving general classes of problems without going into detail on the applications of these methods to the subject matter of specific disciplines. Since students of any discipline usually study computer programming at the same time that they are being introduced to the fundamental

concepts and methodologies of a discipline, they are not prepared to imagine how the solution of nonlinear equations (for example) might apply to their discipline. The authors have recognized that interest in computer programming for students of chemical engineering might be enhanced if they could see how the solutions of general classes of problems developed in computer science courses apply to chemical engineering. Their book might be useful for supplementary reading in a course on computer programming, although it is more likely to be useful for independent study by students in their junior and senior years, or perhaps for a short course offered in a chemical engineering department.

The book is at a very elementary level in terms of both computer programming and chemical engineering. The authors discuss briefly each of several general classes of problems and present computer programs (in FORTRAN Extended Version IV) for specific problems in chemical engineering. The first chapter, on the solution of nonlinear equations, for example, includes applications such as solving the virial equation of state, bubble-point and dew-point calculations, and simple flash vaporization. Other chapters deal with simultaneous linear equations, curve fitting, numerical integration and differentiation, linear interpretation, nonlinear simultaneous equations, and plotting. □

LETTER: Dead States

Continued from page 161.

Chemical Availabilities." This choice of reference state is simple and is compatable with the existing chemical literature, in particular, data on standard free energies of formation. More complex or idiosyncratic reference states defined by European thermodynamicists [2, 3, 5] have been adopted by some U.S. authors [4].

The motivation for these complex reference states appears to be the belief that one needs to and can calculate an absolute or "actual" availability, if the "dead" state of the environment is defined. The "dead" state definition consists of a careful description of the temperature, pressure, and composition of the environment. Once a system's components match this state, the system is "dead" as far as work production in concerned.

The effort to define a "dead" state has yielded a laborious analysis of the average composition of the hydrosphere, atmosphere, and lithosphere to crustal depths [5], and atmospheric "dead" states like that reprinted in the review, wherein the atmosphere is at 100% humidity, giving the actual atmosphere a negative availability, in most places for most of the year; and where the reference state for CO_2 requires that tabulated CO_2 free energy must be corrected for the work that may, in theory but not in practice, be obtained by expanding CO_2 from one atmosphere to an assigned atmospheric partial pressure.

There is less utility in computing an "absolute" or "actual" availability, than in computing an absolute energy. The calculation of the former should be done, according to Gibbs, with respect to the "surrounding medium," that is the interacting, local, environment; which is, of course, so dynamic that it is the universal subject of conversation.

Availabilities like energies have relative magnitudes, computed with respect to reference states. A reference state, is a reference state, is a reference state, and *not* a "dead" state. If it is dead now it will quicken as soon as Summer ends (T_o = 25°C) and the fog lifts (p_{H_2O} = .03 atm).

Sincerely,
Martin V. Sussman
Tufts University

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"The Oxide Handbook," Second Edition, edited by G. V. Samsonov; Plenum Publishing Corp., New York; 463 pages, $75.00 (1982)

"Los Alamos Shock Wave Profile Data," Charles Morris; Univ. of California Press, Berkeley, CA 94720; 488 pages, $35.00 (1982)

"Microemulsions," edited by I. D. Robb; Plenum Publishing Corp., New York 10013; 259 pages, $35.00 (1982)

"Plastics Polymer Science and Technology," edited by Mahendra D. Baijal; John Wiley & Sons, Inc., Somerset, NJ 08873; 945 pages, $150.00 (1982)

"Dust Explosions," Jean Cross, Donald Farrer; Plenum Publishing Corp., New York 10013; 248 pages, $37.50 (1982)