operating parameters such as heating rate will favor different reactions, thus producing different values of ΔH_R and E. Therefore, comparison of the effectiveness of different additives should be performed under identical operating conditions.

CONCLUSION

Much work is needed before one is able to completely understand the role played by additives in the combustion of coal used in industrial and utility boilers. The chemical state of the additive in promoting combustion of CO→ CO_2 is still speculative [8]. Also, the behavior of the coal during combustion will vary according to the physical state of the coal, i.e. molten or dry. It will also depend on the aerodynamic properties such as density and shape and the adhesive quality known as the wettability of coal [21]. We also have to distinguished between combustion of small, and combustion (and gasification) of large, coal particles. □

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ChE book reviews

CHEMICAL REACTOR ANALYSIS AND DESIGN

By G. F. Froment and K. B. Bischoff
John Wiley and Sons, New York

Reviewed by
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This book is a welcome addition to the growing number of books now available in the area of reaction engineering. It is comprehensive, and contains more topics than are covered in most books. The book has two particularly strong points. One is the wealth of *real* examples, and the second is a

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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

Continued from page 176.

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

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Sterling Swift Publishing Co.
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Reviewed by
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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