ChE book reviews

Chemical Kinetics and Reactor Design, A. R. Cooper and G. V. Jeffreys, Prentice Hall (1972). Reviewed by Dan Luss, University of Houston.

This is an undergraduate text on the analysis and design of chemical reactors. The approach is elementary with emphasis on the underlying concepts and techniques as is most proper for the first exposure to this subject. The coverage of several chapters is very good and the chapters on gas liquid and liquid-liquid reactors contain more material than most other texts. On the other hand, several other chapters, such as that on gas solid reactors, are rather superficial and leave much to be desired. In several cases, the authors make errors which indicate lack of knowledge of the literature. For example, they state on page 167 that for a system of first order reactions, "the reaction paths will not be straight lines," or that "the slope condition is sufficient for stability" even though both statements are not true in general. Similarly, the example on p. 133 applies a numerical solution for a problem for which an analytical solution was published already in 1962. Several definitions are rather unclear and that on catalysis fails to point out its important effect on selectivity. It is not clear why a modern text should apply the old height of reactor unit concept for design of packed bed reactors.

The book contains an appropriate number of suitable examples. It is, however, surprising to note that several of them have been taken, with only slight changes in the numerical values, from other texts without giving any proper credit to this fact. The example on butane decomposition is based on a 1939 kinetic investigation. In view of the many improved and more accurate recent studies, application of a more modern rate expression would have been desired. The text contains a rather large number of disturbing printing errors. For example, there is a consistent error in the sign for the rate expression developed on page 112. The captions for some figures are missing and in others there is no marking on the ordinate leaving the reader guessing.

The first chapter treats chemical reactor thermodynamics and applies them to some important processes such as methanol, SO_3 and NH_3 synthesis. Most of this material is covered in the U. S. in the thermodynamic course. The second chapter discusses the kinetics of chemical reactions and the influence of concentration, temperature and changes in volume. This is followed by a discussion of rate expression for complex reactions, chain reactions, and heterogeneous catalysis. Several examples demonstrate techniques for the determination of rate constants from experimental data.

The third chapter contains a discussion of the batch and semi batch reactor for both isothermal and non-isothermal single reactions. A rather comprehensive chapter on the continuous stirred tank reactor follows. It includes a discussion of several optimization problems as well as of the stability and control. A description of plug flow and laminar flow tubular reactors is contained in the next chapter and it covers isothermal and non-isothermal operation, optimal operating temperature profile and the effect of laminar velocity on conversion.

The chapter on flow characteristics and their effects on the performance of continuous reactors presents an analysis of residence time distribution and dispersion models and their application to design for reactions with linear kinetics. A rather brief chapter is devoted to heterogeneous reactors. It describes briefly solid gas kinetics, the effect of diffusion on a first order isothermal reaction and non-isothermal operation. The last two chapters discuss gas liquid and liquid-liquid reactors, and several design examples demonstrate the effect of the chemical reaction on the mass transfer rate.

CACHE Computer Problem

(Continued from page 93.)

and TDEL, the assumed temperature change across the increment.

The subroutine checks if the calculated TB is greater than the specified maximum temperature, TMAXO (°R). If so, TB is set equal to TMAXO and the enthalpy at TMAXO is calculated.

Subroutine PDROP

The pressure drop equation for a gas phase system at high velocities may be simplified to:*

*Hougen, O. A. and K. M. Watson, *Chem Process Principles III*, p. 869, John Wilen & Sons Inc., New York (1947).