TEXT MATERIALS

Before 1977-78 there was available virtually no single source of information which could be used as a text in a course on real-time computing. In 1977 the first volumes of the CACHE Monograph Series in Real-Time Computing, edited by this author, appeared. The monograph series, an attempt to produce a definitive treatment of each major area in the field, will consist of eight volumes initially. All of them will be available in 1979. A listing of the titles in the present series:

I. An Introduction to Real-Time Computing
II. Processes, Measurements, and Signal Processing
III. Introduction to Digital Arithmetic and Hardware
IV. Real-Time Digital Systems Architecture
V. Real-Time Systems Software
VI. Real-Time Applications Software
VII. Management of Real-Time Computing Facilities
VIII. Process Analysis, Data Acquisition, and Control Algorithms

In 1978 a good book dealing with industrial applications of real-time computers was published: *Minicomputers in Industrial Control*, T. J. Harrison (Editor), Instrument Society of America, Pittsburgh (1978).

With respect to the laboratory facilities, the author earlier documented the three real-time laboratory experiments developed at Santa Barbara in reports, a few copies of which are still available:

D. A. Mellichamp and F. Kayihan, *The Tank Pressure Experiment*, UCSB Department of Chemical and Nuclear Engineering Report C-74-1, 79 pp, (August 1974).
D. A. Mellichamp and G. P. Engelberg, *The Digital Computer Controlled Model Railroad*, UCSB Department of Chemical and Nuclear Engineering Report C-74-3, 119 pp, (October 1974).
D. A. Mellichamp and T. W. Moore, *The Heated Bar Experiment*, UCSB Department of Chemical and Nuclear Engineering Report C-76-1, 96 pp, (March, 1976). □

ChE book reviews

CHEMICAL REACTOR DESIGN FOR PROCESS PLANTS; VOLUME I, PRINCIPLES AND TECHNIQUES; VOLUME II, CASE STUDIES AND DESIGN DATA

By Howard F. Rase
Wiley-Interscience, New York, 1977
Reviewed by Charles H. Ware, Jr.,
Commercialization Insights, Poughkeepsie, N.Y.

The author has written this book, as the preface states, "for the professional engineer who either daily or periodically must deal with design or operation of chemical reactors. But in addition to serving as a reference in the personal libraries of professionals, it should also be useful as a textbook for advanced design courses, including courses taught in continuing education." It will serve all of these purposes very well.

Volume I (772 pages) is divided into four parts: basic data and principles of design; general aspects of reactor design; single-phase reactors; and design of reactors for multiphase processes. Volume II (242) pages consists of 14 case studies including three oxidation reactions, two polymerizations, and two hydrogenations.

Part 1 is devoted to reaction rate theory and applications; chemical and physical aspects of catalysis and catalysts; idealized models of reaction rates and reactor performance; and experimental methods and equipment for developing design data. Two chapters devoted to catalysis and catalysts provide a good summary of them with attention to both theoretical foundations and practical considerations. Experimental methods and equipment to obtain chemical reaction data free of transport effects are emphasized.

Part 2 is concerned with selection of reactor type and mode of operation based upon yield and safety, as well as general design considerations such as mixing of reactants, flow distribution, residence-time distribution within reactors, and briefly, vessel design.

Part 3, which comprises almost half of the text in Volume I, covers the design of CFSTRs, tubular, batch, semi-batch, fixed-bed catalytic, fluid-bed catalytic, and many special reactors. In addition to the various design equations, there are numerous drawings of actual reactors and considerable attention is given to flow and heat effects, feed systems, pressure drop, scale-up, start-up and shutdown procedures.

Part 4 consists of an excellent chapter on gas-liquid reactors plus a short account of liquid-liquid reactors. In the former, stirred tanks, sparged vessels, plate and packed columns, trickle beds, and pipeline contractors are considered. Many theoretical and practical aspects are discussed: scale-up, heat transfer, power consumption, pressure drop, design models and procedures, hold-up, mass transfer, dispersion, liquid distribution, and many others. Only the agitated reactor is treated in the last chapter.

The case studies of Volume II have been selected to illustrate various types of design problems. They are indicated in each case, often accompanied by a comment on the principal weakness of the design. The data that are needed are presented, along with intermediate results, alternatives, and bases for decisions.

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2) Possible Suspects: Gurney, Reynolds

From the pathology formula:

$$\frac{98.6 - 80}{1.5} = 12.4 \text{ hours}$$

(or murder occurred at 12 noon)

This formula, however, takes no account of changes in room temperature, or body thickness, and in fact is known to underpredict the time of death except for the first few hours. From our superior knowledge of heat transfer, we have eliminated Prandtl and Nusselt as suspects. □

ACKNOWLEDGMENT:

Helpful comments were provided by Professor J. H. Hand, University of Michigan.

Editor's Note: Professor Gordon's purpose in his solution to the foregoing problem, "In The Heat of the Night," was to illustrate the use of the Gurney-Lurie charts assuming a simple one-dimensional model. Professor Fogler, CEE Problem Section Editor, asked his student, Alan Basio, to comment on this simplified solution. Mr. Basio's reply follows.

TWO-DIMENSIONAL HEAT TRANSPORT

ALAN BASIO
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It was previously assumed that Lurie, the dead man, is an infinite slab. From this assumption, the time is 16.4 hours since Lurie was killed.

I used Newman's Rule and assumed Lurie is an infinitely long slab with a finite width and depth. Newman's Rule in this situation is the following:

$$Y = Y_x Y_y = \frac{T_s - T}{T_s - T_o} = 0.350 \qquad (1)$$

Let Lurie be 10″ deep, as previously specified, and 1.3 feet wide. Use the same values as before for Y and α. There are now two values of X to be found on the Gurney-Lurie Charts:

$X_x = \alpha t/(5/12)^2$ and $X_y = \alpha t/(1.35/2)^2$. The time must be the same in both X_x and Y_y, and the product $Y_xY_y = 0.350$.

Criteria for solution: (1) $Y_xY_y = 0.35$

$$(2) \quad \frac{X_x(x)}{\alpha} = \frac{X_y(y)}{\alpha} = t$$

Results: By trial and error the times are found to be within 2.7% of each other.

$$Y_x = 0.420 \qquad Y_y = 0.833$$
$$X_x = 0.45 \qquad X_y = 0.18$$
$$Y_xY_y = (0.42)\ (0.833) = 0.350$$

$$t = \frac{(0.45)\ (5/12)^2}{0.0058} = 13.47 \text{ hrs.}$$

$$t = \frac{0.18\ (0.65)^2}{0.0058} = 13.10 \text{ hrs.}$$

$$\frac{13.47 - 13.10}{13.47} \times 100 = 2.7\% \text{ difference}$$

If the width of Lurie is 1.3 ft., he died 13.3 hrs. ago, not 16.4 hrs.

The width of Lurie is important. If Lurie is 2.6 ft. wide, for example, he dies 16.3 hours earlier. In other words, the infinite slab assumption improves when Lurie is assumed over 2.0 feet wide, approaching an answer of t = 16.4 hrs. □

BOOK REVIEW: Reactor Design

Continued from page 24.

The book is an excellent work. The author has covered a very large area of relatively difficult material in a highly readable fashion and has provided enough detail so that the reader is able to come to grips with the realities of chemical reactor design. It is accurate and relatively complete. There is a considerable amount of specialized knowledge, based upon over 1000 references, augmented by the author's own considerable experience. In many areas, it stands at the edge of chemical reactor design knowledge that is in the public domain. As such it will continue to be a valuable reference work for many years to come.

Its only major shortcoming is insufficient illustrations and a lack of exercises or problems for the student. The fourteen case studies of Volume II serve to illustrate design principles but only cover a fraction of the material in Volume I. In order to serve as a text for a graduate course in chemical reactor design, it would have to be supplemented by problems developed to reinforce specific points and others which would require the student to integrate these ideas into a chemical reactor design. The latter would be an undertaking of the order of a term paper.

These two volumes are a major contribution to the chemical engineering literature. They belong in the library of every chemical engineer who is concerned with research, development, design, or, in many cases, operation of chemical reactors or conversion processes. □