# BOOKS

**Turbulence Measurements in Liquids,** Proceedings of the Symposium on Turbulence Measurement in Liquids—University of Missouri, Rolla (September, 1969). G. K. Patterson and J. L. Zakin, (eds.), 1971. 155 pages. $8.00.

The proceedings are logically organized into four sections describing the experimental techniques involving optical and probe devices, the measurements as applied to Newtonian liquids, to two-phase flow systems, to polymer containing systems, and to special flow situations. This format is very useful as a guide to the state-of-the-art for chemical engineers active in the field as well as those trying to keep current. For the busy professional in industry the foreward will be one of the most important contributions of this volume.

The significant points that emerge as this field rapidly grows and develops are that the hot-film anemometer probes have now reached the threshold of becoming an important tool in turbulence work, even competing in some cases with the old classic—the hot wire. The laser-doppler velocimeter, although restricted in its use to transparent low velocity systems, is an important tool when there is a special constraint of not disturbing the flow field. The probes based on the electrochemical analog are a practical tool for studying wall turbulence phenomena in clean systems. I think the volume does give a misleading impression that pressure probes are becoming less popular and more limited in their use. In the process industries, however, where highly quantitative interpretation is not required, they are continually and very extensively used.

A true test of the relevance of this volume to practicing chemical engineers busy grappling with the needs of society is whether any part of this volume can find immediate application. Before I was half way through this volume, I found results that were of immediate use in our current Shell work, and action was taken before I resumed reading the rest of the proceedings.

To researchers active in this and related fields a number of conclusions will be of particular value. In two-phase flow work the hot film sensor is useful through its transient response to a dispersed second phase, like gas bubbles. In stirred vessel turbulence measurements one must be particularly careful to establish the velocity vector direction first before quantitatively determining the turbulence components relative to vessel coordinates. Also in stirred vessels there are large corrections to pitot tube measurements owing to high turbulence levels, and that when relative turbulence levels become as high as 50% they begin to lose their meaning as turbulence in the classical sense and take on the character of transient flow as a result of blade passage. In understanding the role of drag reducing polymers, the molecular chains act to reduce the energy density of the turbulence spectra over all frequencies and every position in internal and external flows.

Every chemical engineer will find something here of help and of interest to him in his work. This volume certainly will encourage the use of hot-film sensors in new and increasingly challenging problems involving liquid turbulence.

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**Chemical Plant Simulation,** C. M. Crowe, A. E. Hamielec, T. W. Hoffman, A. I. Johnson, P. T. Shannon, D. R. Woods, Prentice Hall, Englewood Cliffs, N.J., (1971). 368 pages. $16.95.

The purpose of this book is to demonstrate the strategy and technical difficulties involved in computer studies of large chemical processes with a detailed account of a case study conducted by a group of faculty and students at McMaster University using the PACER executive program and an industrial sulphuric acid plant as a candidate for study. Since PACER is proprietary (Digital Systems Corp., Hanover, New Hampshire), the book does not provide the listing for the program and only a few of the algorithms for the unit processes are demonstrated. PACER is one of a class of programs used for the calculation of steady state energy and material balances for chemical processes, a common procedure in industry used for the design and expansion of plants; consequently, the study described in the book is typical of the work done in industry. Exposing senior students to the complexities typical in industry certainly has merit, but whether this makes optimum use of educational time is debatable.

Considerable detail is provided on the analysis of the sulphuric acid plant and on procedures for obtaining the basic data of the chemical components involved. There is also a clear explanation of the structure and use of the PACER program. In general, the book would be useful in providing ideas and guidance to students and engineers in industry who are conducting computer simulations. It will be particularly valuable, however, to those using the PACER program for their simulations.

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**Polymer Science and Engineering,** David J. Williams, Prentice-Hall, Inc., Englewood Cliffs, N.J. (1971). 401 pages. $17.00

The field of polymer science and engineering has been fortunate with the advent of three new books suitable as senior or graduate texts as well as for

(*Continued from previous page*)

reference purposes, within the last two years. In my opinion Prof. William's *Polymer Science and Engineering* is worthy of consideration as a text along with *Principles of Polymer Systems* by Rodriquez and *Textbook of Polymer Science*, 2nd Ed., by Billmeyer. All three should be readily accessible to chemical engineers in the polymer field.

The first half of all three texts cover generally similar material (polymer synthesis, general properties, etc.), but in the last half of *Polymer Science and Engineering* the author discusses viscoelasticity, rubber elasticity, and somewhat more rheology rather than the various commercial polymers and fabrication processes that the authors of the other two books do. Having tried both the commercial polymer and process approach and the additional theory approach with chemical engineering seniors, I found from post-course evaluation sheets that the students much preferred the commercial polymer approach. I feel that the latter part of "Polymer Science and Engineering" is very appropriate in a first-year graduate course. Various instructors will differ somewhat on the nature of material that should be presented, however.

The problems at the end of the text are a great asset to the book. Such problems are almost indispensable in teaching senior chemical engineers.

Two seniors taking a chemical engineering polymer course were each asked to evaluate a chapter for readability, clarity, and depth. They read the chapters on polymer synthesis and found the readability and the depth of coverage very good. The introductory material at the beginning of the chapters was found somewhat disjointed, although perhaps no more so than similar works. The ionic polymerization material was particularly good. Over all, one student slightly preferred *Polymer Science and Engineering* as a text, and the other slightly preferred the text by Rodriquez, which is now used in the course.

In conclusion, *Polymer Science and Engineering* is a welcome addition to the field. It will be of value to all as a reference work, particularly for the latter chapters, and should be considered a serious candidate among textbooks for senior and first-year graduate chemical engineers.

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**Fundamental Principles of Polymeric Materials for Practicing Engineers,** Stephen L. Rosen, Barnes & Noble, New York (1971). 275 pages. $4.95.

This book is one of the publisher's Professional Engineering Career Development Series of "Fundamentals" books. The titles in the series cover a broad range of subjects of interest to the technical practitioner. The relatively inexpensive paperback format is durable and convenient.

Rosen presents the basics of the broad subject of applied polymer science in four main sections: Fundamentals, Synthesis, Properties, and Technology. Emphasis is placed on how a given molecular structure is obtained and how that structure determines practical aspects of processing and properties.

Basic principles are discussed in an informal, sometimes folksy, manner. The qualitative discussion is amplified in some cases by simple mathematical development and numerous "practical" problems and examples. Figures are used to fairly good advantage and quite a bit of jargon is introduced. Since the broad range of subjects discussed precludes any in-depth coverage, basic references are listed for further study.

The book serves as a good introduction for a variety of subjects from polymer chemical bonding to extruder operations. While persons familiar with the field will find little here except a review of basics and a list of reference books and articles they probably already use, chemical engineers who have little or no experience in the area should find the book a good starting place.

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**Controlled Test Atmospheres,** G. O. Nelson, Ann Arbor Science Publishers, Inc. (1971). 256 pages. $17.50.

The purpose of Nelson's book is to present principles and methods for producing various gas atmospheres. The book is aimed at analytical chemists, air pollution control engineers, industrial hygienists, and animal toxicologists. The major topics are the gas laws, air purification, flow and volume measurements, and production of gas mixtures in static and dynamic systems. The book attempts to bring together the many techniques scattered throughout the literature.

The methods and principles discussed are the classic ones. Many of the descriptions are rather cursory. Nelson prefers to reference the literature rather than to present detailed descriptions; this detracts from the book's usefulness. Most of the techniques represent applications of elementary principles; chemical engineers will be familiar with many of those mentioned and will be able to improve some of them.

Nelson treats some material inadequately. For instance:

1. He discusses the relative effectiveness of solid desiccants, but does not give enough information to design a system for a given level of water removal.
2. Equation (47) cannot be integrated as indicated to give Equation (48) (a correct expression).
3. Gas compressibilities are used incorrectly in example 19; Kay's rule would be better to use here.
4. Rate constants for chemical reactions are given without mention of the temperature to which they refer.

The concept of presenting in one volume the principles and techniques of generating controlled atmospheres is good. However, the book could be improved by a more careful, detailed, and in-depth presentation of the material. This could be accomplished in about the same space by eliminating the development of very elementary stoichiometric relationships, by presenting fewer examples of the type where numbers are simply substituted in formulas, and by presenting fewer graphs and tables of handbook data (for example, values of the molar gas constant, conversion factors).

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## ERRATUM

In the Table of Contents for the November 1971 *Journal* the first author of the paper "Axial Dispersion of a Non-Newtonian Liquid in a Packed Bed" is C. Y. Wen, not C. Y. Yen.

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