creases in the projected fuel cycle costs. Hence, a need is cited for further optimization of reload operations, fuel type, shutdown, and power scheduling. Since these in turn depend on a better knowledge of materials behavior, burnup limits, and optimum fuel element design which must be established by experimental tests in a fast reactor, the total fuel cycle with recycle of plutonium or U^{233} is discussed at length.

In spite of the present inability to accurately model fuel cycle costs and performance, a three-fold increase to about 35,000 tons annually in uranium mining and milling is predicted for 1980. Future developments with some of the experimentation and manpower required are discussed in relation to fuel production, enrichment, separation of spent fuel, reactor design, safeguards, and regulation. The academic community is given the task of aiding in orienting management, labor, local government, and the public on the role of safeguards, in addition to conducting and evaluating research to keep safeguards technology abreast of a growing and sophisticated industry.

This collection of papers is an excellent review of the state of the industry and should be comprehensible to the average engineer; but for one not acquainted with the field, the acronyms employed without nomenclature listings make tedious reading and searching. The engineering and economic coverage of the problems encountered in the development of nuclear energy is stressed rather than reactor physics. The long lead times cited in the development of reactors and a proven fuel cycle show that advanced, economical breeder reactors are still in the future as an answer to the impending energy crisis. As an in-depth text for studying segments of the nuclear industry, this book would have little value, but it does give a good overall view of the technology which must be developed.

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Turbulence Phenomena, J. T. Davies, Academic Press, New York (1972). 412 pages. $19.50.

As an initial impression, this book is interesting, contains a great deal of valuable information, and makes a different and definite contribution to the popular (and perhaps overworked) field of transport phenomena. In fact, an alternate title might be "Transport Phenomena in Turbulent Systems."

The book has a rather wide range, touching on all the familiar transport topics and including several new ones. The first chapter introduces the basic concepts of turbulent flow such as types of turbulence, velocity distributions, friction factors, Prandtl's eddy mixing length theory, etc. The next several chapters use the Prandtl mixing length approach to develop logically the forms that correlations should take for heat, mass, and momentum transfer. Separate analyses are made of eddy transfer far from and near surfaces. Included are solid-fluid, clean gas-liquid, clean liquid-liquid, and film covered surfaces.

The final chapters in the book cover various special topics which reflect the author's background in surface phenomena. Interesting discussions of drag reduction, movement of individual drops (as influenced by surfactants), spontaneous emulsification, and dispersion of one phase in another are provided.

The single feature that makes this book unique is a complete absence of differential equations. None are presented and none are solved. The entire analysis is built on the eddy mixing length theory of Prandtl. The emphasis is on understanding the physical mechanism of turbulent flow and how this turbulence influences heat, mass, and momentum transfer.

Since many topics are discussed, the pace of the book tends to be rapid. Often the explanations are satisfactory and interesting. At other times they are not. In places the presentation of correlations becomes almost encyclopedic, making reading laborious. Sometimes topics are included without suitable amplification so that the final result is an incomplete and misleading picture of the subject. Unfortunately, the important topic of mass transfer with chemical reaction was a victim of this error.

The author and publisher suggest that the book is a suitable text for a first course in turbulence which is to be presented either at the undergraduate or graduate level. This is only partly true. The book is, for the most part, readable and the level is approximately correct for the upper level undergraduate or beginning graduate student. However, the introduction provided to some of the basic concepts is not satisfactory. The basic topics are covered too briefly and not entirely clearly; therefore, they would not provide an acceptable base for building the remainder of the course. Introduction to turbulence must come from some other source. This reviewer feels that the main value of the book is its alternate method of viewing turbulence phenomena. Hence, it would be satisfactory as a supplementary text and only if it were suitably supplemented would it serve as a primary text.

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Chemical Reaction Engineering, Octave Levenspiel, Wiley, New York (1972). 578 pages. $16.95.

Professor Levenspiel's second edition maintains the lucid style and clear exposition of the first which made it deservedly popular in teaching chemical engineering reaction kinetics. Although the organization of the book remains largely as before, it has been rewritten in a variety of ways, both small and large, and the reader will note considerable changes, especially in the second portion dealing with nonideal reactors and heterogeneous systems.

Texts in the general area of chemical reaction engineering vary greatly in the topics considered and their depth of coverage. The first half of this book provides an excellent detailed treatment of ideal reactors and, as in the first edition, extensively uses graphical means of explaining reactor performance both for clarifying concepts and for quantitatively comparing the performance of reactors under different constraints. The two chapters on nonideal flow and mixing provide a useful and a more extensive treatment of this area than that found in most books. Considerable attention is given to fluidized bed reactors, to fluid-fluid reactions, and to reactions between a solid particle and a fluid. Heterogeneous catalytic reactions are treated rather briefly as is fixed bed reactor design. Slurry reactors appear in passing, and there is no mention of trickle bed reactors.

One might also classify texts in this field in terms of their relative emphasis in approach on (1) clarifying concepts and providing insights, (2) developing rigorous mathematical treatments, and (3) giving guidance to practical applications, including useful correlations, data, and treatment of real situations. Professor Levenspiel's text seems to fall largely in the first category. The practitioner and the advanced student may profit from other texts which give more detailed guidance to the recent literature and more treatment of the complexities encountered in real reactors. However, the author states that he has set out to write an introductory