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BOOK REVIEW

C. Y. WEN and L. T. FAN, **Models for Flow Systems and Chemical Reactors.** Marcel Dekker, New York (1975).

IN THEIR preface, the authors set out to present a detailed survey of the well-established field of process modelling of flow systems. Whatever small criticisms one can make of their approach and choice of topics, they have certainly provided us with the most comprehensive survey of this subject yet available.

At the heart of the subject is the use of residence–time distributions to provide simplified models of flow systems, as proposed originally by Danckwerts in 1953. Since that time, many hundreds of articles have appeared in the literature, with applications of those techniques, or variations of them, to scores of flow models. Over the years, the relationship between the various models has blurred considerably and, in some cases, the importance of a model has been stretched far beyond the limits of feasibility. It is to the authors' credit that they have managed to place some perspective on a subject which has grown so quickly. In so doing, they have referred to a large number of original articles in a sensible, orderly fashion without overpowering the reader.

The book naturally divides itself into four sections. The first of these, an extended introduction to the techniques and methods of flow systems modelling, is presented in the first three chapters. The remaining sections deal with specific classes of flow models.

Unfortunately, in the first introductory section the authors missed an opportunity to demonstrate unambiguously the objectives, methods, and problems associated with residence time distribution testing. With few exceptions, the emphasis in the introductory chapters is in predicting the residence time distributions which *would* result from tests on a given simplified model. In fact, it is almost always the inverse problem which is of primary interest to engineers—that is, the design and use of experimental data to obtain simplified models for given flow systems.

The authors do present a brief statement on choice of models in Chapter 1 and a more detailed discussion in one of the appendices on the analysis of response data in both the time and frequency domains. However, the problems inherent in the choice of a model and its associated parameters are so great, and the potential for making serious errors of judgement is so large, that I would have thought these deserved much more prominent attention in the introductory chapters, with specific examples in subsequent chapters.

One can certainly not criticize the next section of the book, a comprehensive study of the more important and popular models of non-ideal flow systems. The chapter on velocity profile models is especially valuable since, in the past, these simple models have received rather less attention than they deserved. The relationship between Taylor diffusion models and other laminar flow models is clearly demonstrated and the entire subject is generalised to the case of power-law fluids for which these models are particularly applicable.

But it is in the chapter on dispersion models that the authors are at their most complete, surveying hundreds of papers on all aspects of the subject. They discuss in great detail the inconsistencies involved in the choice of boundary conditions for these models, but mention only casually that in the most important operating regions, the differences tend to be small. This section concludes with a survey of combined or mixed models. In these three chapters the authors have summarised much of the available knowledge on modelling via residence time distribution techniques, and the performance of the resulting models as chemical reactors. Surely, these chapters, which are the heart of the book, will prove to be a standard reference for researchers and practicing engineers.

The third section of the book reflects an abrupt change of pace to the use of models which are distinctly more esoteric and which have yet to find any great application in engineering. It is curious to find these topics included in a text which otherwise represents a survey of well-tested, classical models.

The authors conclude with a well-balanced discussion of heterogeneous models and partially segregated models. They include a large section on gas fluidised beds, with special emphasis on models of bubbling beds and correlations obtained for these models. The chapter on segregation and micromixing is equally complete, but here again, the authors never confront the important inverse problem: how does an engineer discover if segregation plays an important role in a given experimental system, and, if it does, how does he characterise it and predict its consequences?

In summary, the text is clearly of great value as a compendium of information for research workers and, to a lesser extent, students and practicing engineers. There is no doubt that it will be referred to often as the first place to look for information on the more popular flow models in use today. A final note is in order on the book's reproduction method—a photographic offset of typescript. Whatever advantages this method affords they are not reflected in the price of the book.

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