BOOK REVIEWS

Laminar Flow and Convective Transport Processes: Scaling Principles and Asymptotic Analysis

By L. Gary Leal, Butterworth-Heinemann, Boston, 1992, 740 + xviii pp., $79.00

Gary Leal has written an important new text for a first chemical engineering graduate course in transport processes. The emphasis, as indicated by the subtitle, is on methods of scaling and asymptotic analysis for laminar flows of Newtonian fluids. The field equations are rigorously derived, and ten subsequent chapters cover the entire range from creeping flow to boundary layers, including an elegant treatment of the mechanics of bubbles and drops. As one would expect from the author's research contributions and review papers, the exposition is lucid and complete. Indeed, a number of examples are worked out in far more detail than one normally finds in an advanced text, much to the benefit of the student. The book could be used profitably in any graduate program, although most students will have an inadequate background in vector analysis and will require supplementary instruction. It provides a particularly good introduction to matched asymptotic expansions and domain perturbations as tools for the solution of transport problems.

According to the preface, this book evolved from Leal's graduate course in fluid mechanics and *thermal* transport processes. The topics included and excluded have been carefully chosen, and they invite discussion of what is appropriate in a course for chemical engineers. I would insist on at least three topics which are not covered, possibly at the expense of some of the material which Leal considers to be essential. I feel that chemical engineers should be introduced to mass transfer at high rates, where the coupling between mass and momentum transport at the boundary causes the usual analogy between mass and heat transfer to break down. This topic can be added to a discussion of boundary layer flows with little effort, as long as only binary systems are considered. I feel no transport course today is complete without some discussion of numerical methods; I lean towards introducing variational methods and then developing finite-element techniques. Finally, I feel that chemical engineers should be introduced to turbulence in a conceptual framework which goes beyond that in the typical undergraduate course. This is much more difficult to do in the limited time available in the first graduate course.

I have been dissatisfied with the available texts for a first graduate transport course, and in recent years I have not assigned one. Rather, I have recommended to the students that they purchase one of a number of basic texts for their personal libraries and as a reference for some topics in the course. Leal's book comes closer than any other to meeting what I consider to be the students' needs, and it does cover many of the topics which I consider to be essential. I would now place this text at the top of my recommended list.

The book seems to be relatively free of major proofreading errors, although there is an amusing transition to misplaced Greek characters on p. 219. Figure quality is just adequate, but the typeface is relatively easy to read.

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Perspectives in Chemical Engineering Research and Education

Edited by Clark K. Colton, Academic Press, San Diego, 1991, 606 pp., $99.95

The chemical engineering profession came into being in the 1880s simultaneously in Europe and America. The oldest continuous academic program in chemical engineering began in September 1888 at the Massachusetts Institute of Technology, and this volume is a record of a symposium held in 1988 to mark the centenary of that department.

It is worth noting that the new profession at the time had a poor reception in England as a review in *Nature* (Vol. **21**, January 29, 1880, p. 298) of George Davis's first book attests. In the review on the book titled *Sizing and Mildew in Cotton Goods* by G. E. Davis, C. Dreyfus, and P. Holland (Manchester: Palmer and Howe, 1880), the following comments were made: "The application of a certain kind of science to a certain kind of commerce is rapidly producing a literature of its own. It is not long since that we had occasion to notice a work which treated of the manner in which silks could be 'weighted' by chemical means, and the volume now before us is the second of its kind which is concerned with the relations of chemistry and mycology to the manufacture of cotton goods. It is hardly worthwhile to take up valuable space by noticing the merits or demerits of a book such as this, the object, or at least the tendency, of which is to show the manufacturer how, by the application of certain scientific facts and principles, he may seek to perpetuate a system which, we honestly think, is simply a gigantic fraud."

There is no evidence of similar backwoodsman-like thinking in the United States, which perhaps helps to explain why the profession developed so quickly and so successfully there. A chronicle of that success story is well told by L. E. Scriven in the opening chapter of *Perspectives in Chemical Engineering Research and Education*. His article, "On the Emergence and Evolution of Chemical Engineering," is a concise (people might read it!) history of the profession as it was practiced and taught. As would be expected from Scriven, the chapter is full of gems and should be required reading for all undergraduates of the subject. The book is worth buying for this chapter alone.

The remainder of the book is divided