Book Reviews

Bouyancy-Induced Flows and Transport

B. Gebhart, Y. Jaluria, R. L. Mahajan, and B. Sammakia, Hemisphere Publishing Corp., NY, 1988, 971 pp., hard cover $149.95, soft cover $49.50.

Gebhart and his colleagues (a selection of his former students) undertook a monumental task—nothing less than a survey of the bulk of the literature relating to bouyancy-induced flows. Surely, their task was eased by the fact that, over the past 30 or so years, they have personally disclosed much of our present understanding of buoyancy-induced flows. But that shouldn't diminish their accomplishment one whit, and this book is much more than a mere recapitulation or reprinting of the papers the book's authors have published over the years.

I use the word "survey" with some reservation. The authors introduce each topic carefully. They discuss its background and physical interpretation, develop the appropriate mathematical analysis, and provide many of the numerical and graphical results that are essential to an understanding of the phenomena involved and the solution of practical problems.

In a work of this size (slightly fewer than 1,000 pages), with multiple authors, variations in style are inevitable. So too, perhaps, are failures in grammar and syntax. Fortunately, such occurences are rare. Occasionally, the authors do become so involved in the development of the mathematical solution of a problem that they fail to convey a sense of passion for the subject.

The work is available in both text and reference form. The former contains end-of-chapter problems and appendices of selected property values. In text form, the book would be suitable for use in an advanced graduate course in buoyancy-induced flows, but in that case textbook problems usually aren't necessary. In my opinion, the book will be of principal value as a survey of the state-of-the-art in the late 1980's to engineers and scientists who already have a speaking knowledge of the subject. The list of references appears to be especially complete. I, for one, am delighted to add this volume to my bookshelf.

By buoyancy-induced flows the authors mean fluid motion in a (usually) continuous medium, driven by density differences. Such flows are often termed natural or free convection flows and are truly ubiquitous. Other buoyancy-induced phenomena, such as bubble motion, are not covered. Also, discussion of free boundary and surface tension effects, which frequently accompany buoyancy effects, is limited.

The subject of buoyancy-induced flows can be divided in a number of ways. The authors' treatment takes 17 chapters. Following a general introduction and a development of the governing differential equations, the authors take up in succession: external thermally induced flows (which is further subdivided into vertical, axisymmetric, and nonvertical cases); combined mass and thermal transport; unsteady external flows; variable fluid property effects; a special treatment of the flows of pure and saline water in mixed convection. Instability, transition, and turbulence are covered in two lengthy chapters. The balance of the book is devoted to more specialized topics: unstably stratified fluids, transport in enclosures and in porous media, and non-Newtonian effects are covered in four chapters and a number of further specialized topics are briefly introduced in the final chapter.

Roger Eichhorn
University of Houston

Foundations of Boundary Layer Theory for Momentum, Heat and Mass Transfer

Joseph A. Schetz, Prentice-Hall, Englewood Cliffs, N.J., 309 pp. $63.00.

This book discusses boundary-layer theory up to solutions of the Navier-Stokes and energy equations based on the premise that engineering students and young, practicing engineers are today well versed in computer analysis.

Laminar and turbulent boundary layers are given the same breadth of coverage. For each of them, the discussion starts with a presentation of experimental results, proceeds to integral solutions of the momentum and energy equations, to similarity and computer solutions of