Book Review

Transport Processes in Chemically Reacting Flow Systems

Daniel E. Rosner, Butterworths, Boston, 1986, 540 pp., $52.95.

Flows with chemical reaction generally involve the full range of possible fluid dynamic complexity: transport and diffusion of mass, momentum, and energy; chemical reactions, both homogenous and heterogeneous; multiple phases; and radiative transfer. The study of these processes is not solely of academic interest since many flows arising in the aerospace, chemical, and mechanical industries possess such aerothermochemical and geometric complexities.

Professor Rosner has had a long and distinguished career devoted to chemical reactions in flowing systems and thus the present book is based on solid research contributions. But the author notes that it ". . . has evolved from . . . teaching . . . undergraduate and graduate courses dealing with the transport of energy, mass and momentum in chemically reacting fluids to students in engineering (chemical, mechanical, aeronautical, etc.) and applied science (e.g., materials, geophysics/geochemistry, medicine)." Thus we can trust that the expository style has been well tested. The author emphasizes combustion systems as examples of chemical reaction since he considers such systems to provide an excellent vehicle for discussing important concepts without the ". . . dazzling variety of phases, states and chemical species encountered in present-day chemical engineering . . . applications."

After a largely descriptive and qualitative introductory chapter, the conservation principles and constitutive laws for molecular transport are taken up. Chapters 4 through 6 are devoted to momentum, energy, and mass transport, respectively. Chapter 7 concerns similitude, dimensional analysis and the connection between theory and experiment. The final chapter is devoted to problem-solving techniques.

The arrangement and presentation of material supports the notion that this is a pedagogically sound contribution. Each chapter ends with a summary, true/false questions, exercises, references, and a bibliography of supplementary reading material at three levels of complexity. Moreover the text is profusely supported with illustrations, graphs, and tables.

Specialists in particular aspects of flows with chemical reactions, (e.g., those concerned either with the chemical kinetics of combustion systems or with the role of turbulence in such flows) may feel their subject is shortchanged. However, the complete coverage of basic principles in this text provides a structure into which supplementary material can be readily inserted. Thus this book is to be commended both as a teaching text and a reference book for practicing engineers encountering the titled flows in their work.

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