Equilibrium Properties of Fluids and Fluid Mixtures

By Aleksander Kreglewski, Texas A&M University Press, 1984, 253 + xxi pp.

This book is a treatise on both the development and application of equations of state to mixtures and their phase equilibria. The author focuses on subject matter that is probably not well known to the practicing engineer and probably not commonly used by the research engineer. The book addresses to a large degree the author's own work on the augmented van der Waals theory of fluids; to his credit, the author makes a strong case for the theory's use in a wide variety of molecular systems.

The breadth of the book is narrow, in the sense that the most popular two-parameter van der Waals-type equations of state, which have had some success for nonpolar molecules, are not seriously treated. Recent developments in three-parameter equations of state (Martin; Schmidt-Wenzel; Patel-Teja), which seem to have applicability to a broader spectrum of molecules, are ignored. Consequently, the uninitiated reader may gain an unbalanced picture of the current state of the art on equation-of-state usage. This book obviously is not intended to be a review.

The book is designed to be a research monograph rather than a text, although many helpful and insightful thermodynamic derivations are included. Researchers in the chemical industry vis-a-vis the petroleum production industry will find the book of interest. The author restricts his treatment to examples with no more than three components. As a reference, the book will certainly appeal to developers of equations of state. It is the opinion of this reviewer that the book may be somewhat ahead of its time, and its impact on our thinking about equations of state will be greater in a few years than at present.

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Computational Fluid Mechanics and Heat Transfer

By Dale A. Anderson, John C. Tannehill, and Richard H. Pletcher, McGraw-Hill, 1984, 599 + ix pp., $39.95.

The title is rather misleading, as there is virtually nothing on finite-element methods or on heat-transfer applications—a more accurate title would have been *Finite-Difference Methods in Fluid Mechanics*. Otherwise, the book is highly recommended for anybody seriously engaged in numerical methods for "transport" problems. The work is in two parts: *Fundamentals* (Chapters 1–4) and *Applications* (Chapters 5–10).

In Part 1, Chapters 1–3 give necessary introductions to numerical methods, partial differential equations, and finite-difference approximations. Chapter 4 provides a particularly comprehensive summary of the various finite-difference methods for solving hyperbolic, parabolic, and elliptic PDE's; it concludes with methods for Burger's equation, which, with its transient, convective, and diffusional terms, serves as a model for the Navier-Stokes equations yet to come.

Part 2 starts with the basic equations for fluid mechanics and heat transfer; the remaining five chapters provide a highly detailed treatment of numerical methods for inviscid flows, boundary layers, "thin-layer" or "parabolized" and full Navier-Stokes equations, and grid generation.

The writing is clear, the level of detail is generous, there are a profusion of end-of-chapter problems, and the methods that are covered are really up-to-date. However, there is essentially no information on how to handle many important problems involving, for example, free-surface flows (the marker-and-cell method is mentioned but not discussed), non-Newtonian fluids, natural convection, phase changes, or subgrid modeling of turbulence. Common terms, such as convection, latent heat, radiation, Rayleigh number, regeneration, and Stefan problem, are not to be found in the index because the corresponding heat-transfer problems are not simply discussed.

To summarize, the book is first-rate for its finite-difference treatment of many of the more classical problems in fluid mechanics, but those expecting much information on heat transfer will be disappointed.

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