Int. J. Heat Mass Transfer. Vol. 28, No. 12, pp. 2393–2394, 1985
Pergamon Press Ltd. Printed in Great Britain

BOOK REVIEWS

W. Z. Black and J. G. Hartley, **Thermodynamics.** Harper & Row, London, 1985, 755 pp., £14.95

The authors of this beautifully-produced book must have given up the struggle to find a title which is both helpful and different from those of the many similar textbooks in print! However, a quick browse confirms that the book consists of a more-than-adequate coverage of classical thermodynamics for the non-specialist parts of an undergraduate engineering course, and that it is most appropriate to students of mechanical engineering. The 13 chapters, in order, deal with: fundamental concepts; properties of substances; mass conservation; energy conservation (referred to on only one occasion as the first law; entropy and the second law; second-law analysis; gas cycles; vapour cycles; thermodynamic relationships; real gases; gas and gas–vapour mixtures; chemical reactions (effectively limited to combustion); chemical equilibrium. Those who consider the theory of turbomachinery and of compressible flows to form natural parts of a thermodynamics course will have to look elsewhere. Each chapter ends with a concise and useful summary of the ground covered, followed by a large number of problems derived where possible from practical engineering applications. (A solutions manual is mentioned in the preface, without any indication of whether this is also to be published.) S.I. units are used throughout. A bibliography and a typical selection of property tables and charts are included.

Two features of the book distinguish it from its predecessors. First is the strong emphasis on organizing a problem for systematic application of thermodynamic principles; a section of Chap. 4 is devoted to this point and its recommendations are followed in the many worked examples to be found in this and subsequent chapters. Second is the early extension of material on the second law to cover availability and related quantitative measures of the effects of irreversibility, and the use of these concepts in the chapters on cycle analysis. Most teachers will welcome the first of these features; however, those who are less than enthusiastic about the practical value of second-law analysis, in a 'core' thermodynamics course or even in engineering practice, may find that its introduction before simpler concepts such as isentropic efficiency (regrettably called adiabatic efficiency) serves only to confuse.

The material is not always as well ordered as it might be. For example, enthalpy is introduced well before the first law for flow processes, which ought to be the justification for its definition; the term 'irreversible work' occurs before the concept of reversibility. A practice which some teachers will regret is the use of the term 'open system' instead of 'control volume'. In the first chapter, the way in which electrical energy transfer is classified as work is rather unconvincing, but a valiant attempt is made to minimize the confusion which commonly arises when the terms 'heat' and 'heat transfer' are first introduced. On the credit side, in the reviewer's option, are the presentation and use of a general mathematical formulation of the second-law inequality for closed *and* open systems, and the handling of combustion using enthalpies of formation *and* enthalpy of reaction (avoiding the limitations of treatments which concentrate on one or other approach). On the whole, the presentation, including the illustrations, is good. The shaded backgrounds which emphasize the most important equations throughout the book will appeal particularly to students at the revision stage.

The overall approach of the book may be considered somewhat out of step with the trend (in the U.K., if not elsewhere) towards courses with more immediate industrial relevance. While its generally logical progression, from definitions through the laws of thermodynamics to applications, has been the traditional approach and one that can be successfully followed by the potential innovators in the upper part of the ability spectrum, there could with advantage have been more in the early chapters (by way of illustrations from engineering practice) to whet the appetite of the average student. Nevertheless, this is a book which can be recommended. It certainly represents good value for money.

R. I. Crane
Department of Mechanical Engineering
Imperial College, London, U.K.

L. C. Burmeister, **Convective Heat Transfer.** John Wiley, New York, 1983, ix + 790 pp.

The aim of this well-written and well-presented book is to provide a textbook for students starting an engineering course. The author intended to establish a coherent base for the subject and, in my opinion, has succeeded.

The text consists of 14 chapters, with the following headings:

1. Introduction.
2. Kinetic Theory of Gases.
3. Transport Properties.
4. Equations of Continuity, Motion, Energy and Mass Diffusion.
5. One-dimensional Solutions.
6. Laminar Heat Transfer in Ducts.
7. Laminar Boundary Layers.
8. Integral Methods.
9. Turbulence Fundamentals.
10. Turbulent Boundary Layers.
11. Turbulent Flow in Ducts.
12. Natural Convection.
13. Boiling.
14. Condensation.

Seven useful Appendices, an author index and a subject index close the book. In the introduction the author presents the rate equations and the analogies between the transport properties. The treatment of convective transport begins in Chap. 2, at the molecular level for a gas, and continues in Chap. 3, where it is shown that the transport properties of mass diffusivity, thermal conductivity and viscosity naturally arise. In Chap. 4 the partial differential equations that describe the continuous fluids convective behaviour are derived and discussed. The major points discernible from the equations in Chap. 4 are emphasized by solution of well-chosen one-dimensional problems in Chap. 5. They include Couette and Poiseuille flows and Stefan's diffusion problem. Chapters 6–8 extend the forced-convection considerations to laminar flows in ducts and boundary layers; adequate consideration being given to such interesting topics as variable-property effect on boundary layer, similarity solution for flow over a wedge, transpiration on a flat plate, finite-difference solutions, and integral methods. Chapters 9–11 deal with forced turbulent flow in ducts and boundary layers, and include some of the most recent turbulence models (one- and two-equation), as well as finite-difference solutions. The last three chapters (12–14) are devoted to natural convection, boiling and condensation.