Int. J. Heat Mass Transfer. Vol. 13, p. 1641. Pergamon Press 1970. Printed in Great Britain

BOOK REVIEW

J. R. WELTY, C. E. WICKS and R. E. WILSON, **Fundamentals of Momentum, Heat and Mass Transfer.** John Wiley, New York (1969). 572 pages, 535 problems, Wiley International Edition, 88*s*. ($\sim$ $10.55).

ABOUT a decade ago in the United States, the Grinter report recommended specific areas of study which should be in every engineer's education. Of these areas, "rate processes" could include fluid flow, heat transfer or mass transfer. Consequently, with the establishment of "engineering core" programs in many schools, some incentive arose for developing combined courses in energy, mass and momentum transfer at the junior level. However, the entrenched traditional disciplines have often avoided sharing their resources with the excuse, among others, that there was not a suitable text. Welty, Wicks and Wilson seek to eliminate this excuse. Two of them are mechanical engineers and the third is a chemical engineer; so the major camps are represented in the appropriate areas. And since there is only slight mention of compressible flow, civil engineering departments may even find it acceptable (problems in the chapter on flow in closed conduits are mostly for water).

The first six chapters cover the application of the laws of conservation of mass and energy and Newton's second law of motion to control volumes. Subsequent portions involve derivation of governing equations and their application to momentum transfer, heat transfer and mass transfer in roughly equal proportions. In general, the organization is comparable to that of Knudsen and Katz [1], also from Oregon State University.

The book is attractive. It is written clearly and is well endowed with thorough example solutions and homework problems, with numerical answers to a third. Derivations of governing equations are developed by taking advantage of the definitions of partial derivatives, thereby avoiding embarrassing questions on which small terms to neglect. Intermediate steps are detailed and the pertinent restrictions are often listed along with the resulting governing equation. The usual appendices appear plus a couple for parameters used in the Lennard–Jones approach for predicting viscosities. Notably missing is a separate listing of nomenclature. "Three English systems of engineering units" are employed primarily, but in the sections on mass transfer, metric units also occur; it is hoped that a complete conversion table accompanies the International Edition.

The chapter on the effect of turbulence on momentum transfer has not benefitted from the research of the last decade; on one hand, we are given a mixing length, $L = Ky$, in the neighborhood of the wall; and on the other, a laminar sublayer, $v^+ = y^+$, with no discussion of the apparent contradiction. (On accompanying Fig. 13.6, there is evident confusion between Reichardt's profile and a logarithmic equation (13–22) for the buffer layer of a three-layer model.)

This reader was distressed to see the Bernoulli equation first presented as an energy equation. Use of dimensional analysis emphasizes the Buckingham Pi theorem; classroom presentation might benefit by supplementing with Kline's monograph [2]. In the treatment of extended surfaces, it would be desirable to provide a criterion for the validity of the assumed isothermal cross-section in the derivation. While one may reasonably argue that basic fundamentals do not change, if methods of solution are included, they should be up to date. But in this text, the antiquated Schmidt plot takes the place of simple numerical analyses for transient problems, and numerical methods do not appear to be considered for convection problems. Very few recent papers are mentioned as references. One receives the impression that the book was written ten years ago. As an introduction to heat transfer, this reader feels that Kreith's text [3] has not yet been surpassed.

Fundamentals of Momentum, Heat and Mass Transfer is an introductory text, pure and simple. If the instructor is concerned with his students' purses, he should find three introductory books for about $10 to be quite a bargain these days.

D. M. MCELIGOT

Dept. of Mechanical Engineering
Imperial College, London S.W.7
and University of Arizona,
Tucson, Arizona, U.S.A.

REFERENCES

1. J. G. KNUDSEN and D. L. KATZ, *Fluid Dynamics and Heat Transfer*. McGraw-Hill, New York (1958).
2. S. J. KLINE, *Similtude and Approximation Theory*. McGraw-Hill, New York (1965).
3. F. KREITH, *Principles of Heat Transfer*. 2nd Edn. International, Scranton (1964).