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BOOK REVIEWS

Fundamental Principles of Heat Transfer, STEPHEN WHITAKER. Pergamon Press, Oxford (1977). 576 pp. price $50.

AS THE art of politics is to distinguish between a band waggon and a sinking ship, so is that of engineering to identify the golden mean from shabby compromise. This philosophic reflection was engendered in your reviewer by this new textbook on heat transfer. The writer of a textbook on this subject (and, indeed, most other engineering topics too) has to choose between a number of possibilities. There is the genuinely introductory text, which sets out the elementary principles for the student (in the widest sense) of a subject who has no need or desire to proceed beyond the basic knowledge properly required of an educated engineer. Fishenden and Saunders' text might be quoted as the classic example in heat transfer, despite its now great age. Then there is the true textbook for the engineer who needs a working (in its literal sense) knowledge of the subject as it is currently practised, and which final degree courses ought to provide. Eckert and Drake's "Heat and Mass Transfer" can be quoted as an excellent example of this gendre. Finally there is the reference text book which can take the practising specialist to as near the current boundaries of knowledge as is feasible in a rapidly developing subject. Jakob's "Heat Transfer" is the exemplifier of this category. It is your reviewer's belief that to seek a compromise between any of these three separately desirable objectives invites an inevitable descent between two stools; certainly he is reinforced in this view by the present text.

It comprises 534 (excluding Appendices) $18\frac{1}{2}$ cm $\times$ $11\frac{1}{2}$ cm pages which certainly excludes it from our first category. Although the author describes the text as being at "an introductory level", this is presumably to be interpreted as placing it in our second category. And yet, for example, the final chapter on Design of Heat Exchangers, which is most likely to be the prime concern of the working engineer is shorter in length only than the opening introductory chapter, and deals, albeit with considerable algebraic complexity, with a restricted class of heat exchangers, and omits any reference at all to regenerative or capacitance types.

Radiation, on the other hand, is treated in two separate chapters, the first of which includes the derivation of the photon transport equation. There is enough reference to quantum mechanical concepts to suggests a reference-book like desire by the author to give the basic physics of the subject and yet in the end Planck's Radiation Law is presented as a *fait accompli*. Most engineers would see little benefit over the more normal presentation of the Stefan Boltzman equation as the starting point for even the most detailed radiation studies.

Separate chapters on steady and transient conduction, surely not necessary in this age of numerical analysis, where time is treated as just another dimension, suggest also a desire by the author for a reference-book type of approach. So also does the lengthly treatment of Momentum and Energy Transport in Chapter 5, and the separate Chapter 6 on Turbulent Flow. And yet this latter does not proceed beyond the now largely superceded mixing length turbulence model.

If the author wishes to be judged only in the second of our categories, that of the true text book, from which cost (£27.50) and length alone would seem to exclude his work, he must also be criticised for his concentration on the British System of units in this increasingly metricating age. Nevertheless, despite the criticisms which prevent this reviewer from recommending Professor Whitaker's book in any of the three categories described, the author must be complimented on the clarity of his style and his efforts to link the subject matter of each chapter to practical problems. It is not intended as a very serious further criticism to suggest that a lone climber on the top of a mountain consuming bars of chocolate seems an unlikely engineering choice for the illustrative example of Radiant Energy Exchange.

F. J. BAYLEY

Transport in Porous Catalysts, R. JACKSON. Elsevier, Amsterdam (1977).

THIS monograph deals with the laws of gas transport in porous catalysts, their origins and physical interpretation, and their use in modeling catalyst performance. The treatment is clear and incisive throughout; it is readily accessible to readers acquainted with elementary transport theory.

Four of the twelve chapters deal with kinetic theories of gas flow and diffusion; one with surface diffusion; two with structural models of porous media; two with experimental considerations; and the final two with the modelling of reactive pellets. Two appendices deal with the effects of temperature gradients, and with the important experiments of Thomas Graham and Osborne Reynolds.

Workers in this difficult area will welcome the clear discussions of slip boundary conditions, pressure-gradient effects, smooth-field approximations, and departures from the latter under reaction conditions. Some useful strategies for solving the multicomponent conservation equations are also described, including an ingenious one based on stoichiometric flux relations for multiple reactions. The origins and range of validity of such stoichiometric flux relations are clearly discussed.

This book is a useful reference on porous media and on their behavior in catalysis. It would be a useful supplemental text for advanced courses in these areas.

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Handbook of Essential Formulae and Data on Heat Transfer for Engineers, H. Y. WONG. Longman, London, New York (1977). 236 pp. U.K. price £4.95.

IN HIS preface, the author states that he is setting out to present a reference book for practising engineers who would appreciate having a summary of useful formulae made available to them. The task thus defined by the author has been adequately achieved, and the use of his text is enhanced by units and conversion factors, thermophysical properties, mathematical functions and references for property values, provided as Appendices.

The book is a handsome, well-written and informative account of heat-transfer formulae giving, in a text of 236 pages, easy access to information. It is divided into 6 chapters and an introduction. The 6 chapters are Heat Conduction, Heat Transfer by Convection, Thermal Radiation, Boiling and Condensation, Heat Exchangers and Building Heat Transfer. It is in the chapter "Heat Conduction" that the author is at his most complete. I particularly appreciated the tabulation of all the common differential equations in heat conduction with their general solutions and the various boundary conditions.

The chapter on Convection is also very satisfactory but it may become more complete in a future edition of the book.

For example, formulae for heat-transfer coefficients in oblique flow to a tube bundle, and the formula of Brandt (FDBR-Handbuch, Wärme-und Strömungstechnik Mai 1972, F222) for subcooled flow perpendicular to a tube bundle, could usefully be included.

The chapter which I found the least satisfying, although still useful, is the one on Boiling and Condensation. I would like to have seen a more complete account, including, for example: subcooled boiling heat-transfer correlation of Jens and Lottes (1951); heat division parameter, Bowring (1962); criteria between saturated boiling heat transfer and film boiling heat transfer; formulae for the superheated region (Heinemann), etc. Due to the increasing importance of two-phase heat transfer, and to the lack of a corresponding handbook on the subject, the author might care, in a future edition of the book, to include a separate chapter on such formulae (or to combine it with the Boiling and Condensation chapter). The inclusion of such topics as convection heat transfer in annular flow, prediction of burnout, etc which the author apparently believed to be beyond the scope of this book, would be truly useful (a starting point for relevant information could be a recent treatise on *Two-Phase Flow and Heat Transfer* Atomic Energy Research Establishment, Harwell Series, edited by D. Butterworth and G. F. Hewitt, Oxford University Press, 1977).

The present treatment uses S.I. units throughout, and the process of understanding has been aided by a brief presentation, at the beginning of each chapter, of the essential facts and the basic principles pertaining to heat transfer. Many useful references supporting this discussion help the reader to find more detailed information on special subjects. Notation and definition of heat-transfer terms (I found a few of the latter not very rigorous), also given in each chapter, can be read with profit by newcomers to the field.

Whatever small criticisms one can make of the book, the author has certainly provided us with a comprehensive and valuable compendium of information for practising engineers, research organizations, consulting engineering offices, and students at various academic levels.

There is no doubt that it will be referred to often as the source of information on the more popular and well established formulae in use.

At £4.95 this book is good value.

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ERRATUM

D. J. Shlien and S. Corrsin, Dispersion measurements in a turbulent boundary layer, *Int. J. Heat Mass Transfer* **19**(3), 285–295 (1976).

The values given on page 293, first column, eighth line from the bottom (as well as the appropriate values given in the Abstract and Conclusions) should read:

"1.7, 1.4, 1.6, 1.2" instead of "0.80, 0.73, 0.82, 0.56".

Also in the line just above it, "$0.6u^*\delta$" should read "$0.06u^*\delta$", a typographical error.