Int. J. Heat Mass Transfer. Vol. 5, pp. 101–103. Pergamon Press 1962. Printed in Great Britain.

BOOK REVIEWS

Heat Transfer. B. GEBHART, McGraw-Hill, New York, 1961, 83*s* 6*d*.

THIS is a first class textbook for a postgraduate course on heat transfer. It is very well written—both lucid and concise. Most fields of engineering are now so extensive that the modern educational trend is to eschew compilations of results and applications, and concentrate on methods of approach. Heat transfer is no exception and Professor Gebhart has produced an excellent bridge on these lines between the undergraduate course and advanced works such as those of Carslaw and Jaeger, Schneider, Jakob, and Schlichting. Just the right number of references are given to enable the reader to carry each topic further—too many can be discouraging. The author never loses sight of, nor ceases to emphasize, the physical significance of his equations. This is also an excellent feature of the rival work by Eckert and Drake with which inevitably this book will be compared. Both books should be on the shelves of teachers in technical colleges and universities, who will be assisted thereby to give a better direction to undergraduate courses in heat transfer.

After an introductory chapter, the usual division into the three modes of heat transfer is adopted. The differential equations for conduction (steady, unsteady, and with internal heat generation) are developed, and a few one- and two-dimensional cases which can be solved by relatively simple analytical methods are described. A good introduction to numerical methods then follows for more complex problems. The Heissler curves for transient problems are included and periodic processes are discussed.

Two chapters are devoted to radiation from black and grey surfaces, including a fairly complete discussion of "angle factors" and a generalized method of dealing with radiation exchange between any arbitrary number of surfaces. Apart from a brief mention, the absorption and radiation characteristics of gases has been left wisely to more specialized texts.

As a prelude to convection, a chapter is devoted to fluid flow with sufficient examples to enable the reader to become familiar with approaches via equations of mass and momentum, boundary layer theory, and integral methods of boundary layer analysis: a good piece of selection, making for easy transition to Schlichting. A nice balance of rigour is achieved also: for example, the Navier–Stokes equations are partially derived but the lengthy derivation of the terms necessary to cover compressible fluids is omitted. The approach to turbulence is via the concepts of eddy viscosity and mixing length, and the universal velocity profiles are described.

At this point the author seems to be worried by the prospective length of his book. Examples of methods of attack begin to diminish in number and are too often replaced by mere statements of results or directions to the literature. After introducing integral methods in the fluid flow chapter, it is difficult to see why their use is not illustrated in the discussion of convection. One feels that space that might have been given to a fuller treatment of heat transfer is devoted to a rather sketchy mention of mass transfer. Likewise, the treatment of the Reynolds and von Kármán analogies is rather condensed, and some of the assumptions might be discussed more fully. A good feature is that, as a change from the usual dimensional analysis for arriving at dimensionless groups, the method of "differential similarity" based upon physical reasoning is employed. Combined forced and free convection is given a useful coverage. There are interesting sections on kinetic heating and heat transfer in the slip-flow and free molecule regimes—which are topics of increasing importance—but these again would need to be expanded to be in keeping with the first half of the book. One would like to see another hundred pages devoted to convection.

The remaining chapters cover a useful range of subjects, but these, one certainly cannot expect to be treated on the same lines as the more fundamental parts of the book. At the present time, chapters on boiling and condensation must be mainly a discussion of empirical results and a guide to the literature. The chapter on combined mechanisms deals with a selection of problems, including rods and fins, and applies numerical methods to combined-mode problems. Heat exchanger design then follows, including consideration of "compact designs" (with reference to the work of Kays and London) and an approach to optimization. The final chapter on the principles of various experimental analogue methods is very good indeed.

A generous collection of problems is provided at the end of each chapter, but the value of the book to postgraduate students working on their own would be enhanced if the answers were also given.

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Fourier Transforms. R. R. GOLDBERG, Cambridge University Press, 1961, 76 pp. 21*s*.

THE title of this Cambridge Tract may suggest to the readers of this journal a work concerned, like Sneddon's book of the same name or Tranter's "Integral Transforms", with applications of transforms to boundary and initial value problems in mathematical physics. In fact, however, the book is a careful and rigorous exposition of the modern theory of Fourier transforms, but is not directly relevant to, for example, heat conduction theory.

A. TALBOT