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BOOK REVIEWS

R. CLIFT, J. R. GRACE and M. E. WEBER, **Bubbles, Drops and Particles.** Academic Press, New York, 1978, 380pp.

THIS BOOK gives a critical review of the literature on the fluid mechanics, heat transfer and mass transfer of single bubbles, drops and particles moving through a continuous medium. The book has 12 chapters and in the first seven emphasis is on the flow past rigid particles of spherical or other reasonably simple shapes. It is only in Chapter 8 that deformed fluid particles are considered and the only interaction effects discussed are those of the wall in Chapter 9. Chapter 10 deals with surface effects and the very important topics of accelerated motion and the formation and breakup of fluid particles are briefly (compared with earlier parts of the book) discussed in Chapters 11 and 12. The important topic of rapid phase interchange and its influence on the continuous medium does not seem to be discussed in detail.

The reviewer has two main criticisms of the book. Firstly, its range is limited as far as scientists and engineers interested in particulate systems are concerned; it does *not* deal with systems containing many bubbles or particles with the possibility of interaction and its does *not* deal with rapidly flowing systems with significant phase interchange and acceleration, as encountered in multiphase flow. Secondly, although the authors have attempted to pull together the many papers in their field, the book is still difficult to read just as a Ph.D. literature review is often difficult to read. The reviewer would have preferred a book less exhaustive in its literature citations and more single minded in presenting a unified point of view in the manner of Batchelor's book on fluid mechanics or Levich's book on physicochemical hydrodynamics, both quoted as references by the authors.

It is, perhaps, unfair to criticise a book for what it has not attempted to do. At 380 pages, the book is long enough even with its limited scope, and emphasis on the steady, translational motion of single particles through unbounded, incompressible, Newtonian fluids. Although an attempt is made to synthesise the various theories of drag and convective heat and mass transfer (with no chemical reaction) it is difficult for the book not to appear as a compilation of empirical correlations. It is also perhaps unfair to ask the authors to write a definitive, cohesive monograph on a subject with diffuse, semi-empirical theories as it stands today. Perhaps it is too early to write such a book.

No doubt workers in the field will find the book very useful for reference purposes. The references are extensive and reasonably up-to-date (1976) for a book published in 1978. However, it is a book likely to date quickly, and the book would have been much more valuable if 'many-particle' systems had been included. I expect the book to find its way on to the shelves of many research libraries and be a starting point for many Ph.D. candidates over the next decade.

HUGH C. SIMPSON

U. GRIGULL and H. SANDNER, **Wärmeleitung,** Springer, Berlin (1979). (in German). 36 DM.

THE BOOK offers a concise treatment of heat conduction to the extent as it is generally taught at German Universities to students in mechanical engineering, electrical engineering, and chemical engineering. The 11 chapters cover the following topics: thermal conductivity in metals, alloys, rarefied gases and composite materials; one-dimensional steady and quasisteady heat conduction; insulated pipes; containers; fins; steady multi-dimensional heat conduction analyzed by conformal mapping, fictitious heat sources, relaxation, and experimental analogies. The form factor is introduced as a handy tool for the practitioner. Unsteady one-dimensional heat conduction: solution of the Fourier equation for the semi-infinite body, the slab, cylinder and sphere, dimensional analysis, Duhamel's method, Laplace transform, approximate procedures, finite difference approach, experimental analogies, heat explosions, moving heat sources, and heat conduction in media with phase change. Product solutions for unsteady multi-dimensional conduction. An appendix lists the units in the SI system, conversion of units, physical constants, dimensionless parameters used in heat transfer, thermo-physical properties of solids, liquids, and gases, and tables of frequently used mathematical functions. It may be worthwhile to extend in a new edition the discussion of finite-difference methods as they have been developed for computations with electronic computers because heat-conduction problems are more and more solved by this method.

In summary, the topics are well selected and are clearly presented so that the development can be followed by readers with moderate knowledge of advanced calculus. The book can be recommended for students as well as practising engineers. It will also be found useful by anybody else with an interest in heat transfer.

E. R. G. ECKERT

T. C. ADAMSON JR. and M. F. PLATZER, **Transonic Flow Problems in Turbomachinery,** Hemisphere, Washington.

THE VOLUME *Transonic Flow Problems in Turbomachinery* edited by T. C. Adamson Jr. and M. F. Platzer stands out as a major contribution in the literature of transonic turbomachinery and thus an essential for workers in this field, not because it is a high quality presentation of this subject, but because it is the only literature in the field bringing together several different authors with both similar and diverse approaches. The book is a report of the proceedings of the Project Squid Workshop on Transonic Flows in Turbomachines held in the Naval Postgraduate School in Monterey in February 1976 and the editors have had the task of bringing together the various texts with a degree of uniformity. In this task they have not been completely successful in that some authors have extended themselves to 30 or 40 pages and others have contented themselves with little more than abstracts of a few pages long. In the reviewer's opinion a right compromise exists firmly in the middle of these extremes.

The work is split into four parts:

(1) Basic Formulation for Transonic Flow Problems in Rotors;
(2) Analysis: Computational Methods;
(3) Viscous Effects in Transonic Flows;
(4) Experiment.

The reviewer found particularly useful the perspective given to various iterative steady schemes and alternative time marching schemes for transonic flow computation. Many papers dealt with shock waves by the well known smearing techniques and a single paper was devoted to shock fitting. Many experimental papers were devoted to laser-doppler anemometry; and occasionally theory and experiment were

compared. Throughout the volume, little attention was paid to how the design engineer in turbomachinery is going to use the tools that are being constructed on his behalf to improve the quality of his design. Perhaps this activity is the second phase of work in such a subject, but nevertheless, one that should be coming visible at this stage in the development of analysis methods for transonic turbomachinery.

This book is in no way one for other than a reader with an in-depth knowledge of the subject. A newcomer would require considerable tutoring before he could move sensibly through various contributions in the book. Nevertheless, all the essential ingredients are dealt with; and references to more basic papers are given by the different authors. It must be borne in mind that this is a US document and little mention of the not inconsiderable contributions made in the UK and Europe, for example calculational methods developed by D. B. Spalding and his team and J. C. Denton in Cambridge, experimentally the work of H. Weyer at D.F.V.L.R. and L.D.A. receives only passing mention. With these thoughts in mind this publication cannot be considered complete and authoritative; but it is nevertheless very worthwhile and brings together many, though not all, of todays contributions on the subject.

R. HETHERINGTON