always more for library shelves than for the collections of individuals, and I believe that readers should make sure that their Libraries have a copy.

JOHN F. CLARKE

Turbulent Forced Convection in Channels and Rod Bundles: Theory and Applications to Heat Exchangers and Nuclear Reactors. S. KAKAC and D. B. SPALDING, Vols. I and II. Hemisphere (1979).

AT A NATO Advanced Study Institute held in Istanbul in 1978 sixteen invited lecturers reviewed advances in current knowledge of turbulent forced convection in pipes, channels and bundles of rods or tubes. In addition fifteen research reports were contributed. This material is presented in these two volumes and provides a comprehensive guide to the current state of knowledge on turbulent forced convection. The Institute was a summer school and the material will be readily accessible to many people from new research workers to practising engineers.

The two volumes cover a broad range of topics (not all coherent with the title theme) and there are some excellent review lectures. These include Pletcher on current approaches to turbulence modelling, Spalding on the solution of the conservation equations, Bergles on augmentation of heat transfer, Durst on hot-wire and laser–Doppler techniques, and Collier on two phase flows within rod bundles. A number of intriguing phenomena are reported: some of these can be found for example in the lecture by Jackson and Hall on the influences of buoyancy on heat transfer in vertical tubes. Zaric gives a comprehensive review of the intense research into the physics of turbulence, which has revealed evidence of coherent structures in the wall layers of turbulent flows. The suggestions by the review lecturers for further research on turbulence and forced convection are a valuable part of the publication.

The material brought together in these volumes is evidence of a considerable retreat from some of the more optimistic claims made for the predictive power of turbulence models and numerical solution procedures. A number of contributors provide a sober and balanced assessment of these procedures although it is rarely made clear why a particular model is felt to be inadequate. Specific criticism of existing models is more valuable than a general call for more validation. The scarcity of good reliable experimental work is noted in several papers and there is some agreement that models need to be based on very careful measurements of the turbulence structure (especially in complex geometries) rather than on their ability to reproduce the gross features of turbulent flow.

It must be said that several papers (mainly from authors whose native language is not English) are marred by many typing errors some of which verge on the plausible: on p. 436 "the viscous sublayer and the butter layer". The publishers may also note that the text on p. 597 is incomplete and the abrupt ending of a paper on p. 1034 also suggests that some text is missing.

Nevertheless, the two volumes contain an up-to-date account of progress in turbulent forced convection in complex channels, point to deficiencies in current knowledge, and indicate areas in which further work is required. They will be useful and informative to a range of workers including designers, specialists who wish to broaden their knowledge and young research workers.

W. J. SEALE

Recent Developments in Theoretical and Experimental Fluid Mechanics. U. MÜLLER, K. G. ROSENER and B. SCHMIDT (editors), Springer, Berlin (1979). 642 pp. Price $48.40.

THIS volume is a fiftieth birthday Festschrift for Professor J. Zierep of Karlsrühe; and, though some of its contents show the signs of artificial stimulation associated with such occasions, the volume as a whole serves as an excellent introduction to current activities, especially by German fluid-dynamicists.

Part I, entitled Compressible Flow, has chapters on: transonic flow; supersonic flow; nozzle flow: rarefied-gas flow; and computational gas dynamics. In Part II, entitled Incompressible Flow, the chapters concern: stability phenomena: boundary layers; jet flow; airfoil theory; fluid machinery; and miscellaneous problems. There is also a list of publications by Professor Zierep, and a respectful and informative dedication to him. The individual papers are in either English or German, the former language being predominant.

Although it is not especially appropriate in a review for this journal to comment extensively upon the purely hydrodynamic papers, that by Rizzi does deserve comment; for it shows, by way of numerical computations, how remarkably successful is an early analytical expression, devised by Zierep himself, in predicting the shape and position of the shock which is formed ahead of blunt slender bodies when the Mach number is only slightly greater than unity. Transonic flows being so troublesome to predict as a rule, it is encouraging to know that, approached with insight and a flair for simplification, they can sometimes be found to obey conveniently formulated rules.

For heat-transfer specialists, one of the most interesting papers is that of Jischa and Rieke, who derive, from a differential equation for the turbulent heat flux, the expression:

$$Pr_t = A + B(Pr + 1)/Pr,$$

where A and B are constants to be determined empirically. They show that, with A = 0.825 and B = 0.0309, this equation fits the liquid–metal data as well as does the formula of Rohsenow and Cohen (previously the best available); but it is a better fit for air.

Other papers concerned with heat and mass transfer processes deal with, among other things: the "granular" (cellular?) appearance of the outer layers of the solar atmosphere; the motion of red corpuscles in the arteries; various convective instabilities; and heat transfer in the channels of a rotary heat exchanger.

Reproduced photographically from typescript of high quality but varying styles, and proof-read with understandable trans-lingual fallibility, the book cannot be put in the topmost bibliographical category; but it is well bound, and agreeable to handle: and it should certainly be bought by libraries attempting comprehensive coverage of fluid mechanics or convective heat transfer.

D. BRIAN SPALDING