BOOK REVIEWS

Advances in Turbulence
W. K. George and R. Arndt, Eds.
Hemisphere Publishing Corp. 1989

This book is based on a symposium held in 1986 to honour Stanley Corrsin, one of the best-loved people in fluid dynamics. Papers were contributed by many of his former students and others influenced by his work. By heartbreaking coincidence, Stan died after a long illness the day before the symposium started: anybody aspiring to a career in science, especially as an adviser of research students, should read the affectionate but factual "In Memory" tribute by the editors, which ends "...seeking new knowledge is fun and a truly human experience."

Who, apart from the many members of Stan's spoof "Society for Statistical Geometry", should buy this book? It surveys the whole field of turbulence research as at mid-1986, and, although some of the original research contributions have since been published in fuller form in archive journals, the review papers are still timely and stimulating. Therefore it can be recommended to any graduate student or research worker studying turbulence.

John Lumley's lead paper "The state of turbulence research" is a lively and combative survey: it refers to the passing, in the last few years, of some of the "big guys" of turbulence research—Stan himself, his Caltech contemporary Janos Laufer and his Johns Hopkins colleague Laszlo Kovasznay, and, more recently, that giant of the previous generation A. N. Kolmogorov, whose theory of local isotropy Stan extended to scalar fields.

Parviz Moin and Philippe Spalart discuss the contributions of numerical simulation data bases to the "physics, modeling and measurement of turbulence"—the topics nearest to Stan's heart. Bill George contributes a provocative article on self-preservation, exposing the nakedness of simple arguments (ignoring the necessary equality of mean-flow and turbulence scales in a truly self-preserving flow).

Dale Taulbee contributes an excellent review of "Engineering turbulence models", which, even in the 1990s, should be required reading for any academic or industrial worker at the sharp end of turbulence research. Rene Chevray's review of "Chaos and the onset of turbulence" is a sane and extraordinarily comprehensive survey, including a hilarious discussion of Spanish and Portuguese estimates of the length of the coast of Portugal. Prince Henry of Portugal, called The Navigator, sent his trainees out to explore the world: he must have had much the same talents as Stan Corrsin.

Preben Buchhave's authoratative review of turbulence measurement techniques recalls Stan's involvement in hot-wire anemometry in the days when men were men and amplifiers were not. Tom Mueller's final paper on flow visualization and hot-wire anemometry happily terminates this volume, which celebrates one of the great experimentalists—and characters—of fluid dynamics.

Peter Bradshaw

Computational Fluid Dynamics
G. de Vahl Davis and C. Fletcher,
North-Holland

This hardcover volume contains most of the 16 invited and 58 contributed papers presented at the International Symposium on Computational Fluid Dynamics held in Sydney in August 1987. The absence of eight papers, among them five invited ones, is betrayed by the curious inclusion of related brief summaries, and reflects, presumably, the authors' desire to see their papers appear between more prestigious covers. Of the eleven contributed articles appearing in full, only a small minority combine quality with the degree of breadth and lucidity one hopes to find in lead papers. Two articles, one by G. F. Carey (University of Texas) on supercomputing in CFD and the other by P. E. Rubbert (Boeing Company) on CFD in airplane design, effectively form this minority. Both provide historical perspectives and give useful descriptive expositions of the status in 1987. Fairly broad, though less readable, accounts are provided by V. M. Koveny, A. S. Ledger and G. Cherny (USSR Academy of Sciences) on some operator splitting and fractional-step schemes for the Euler and NS equations, and by Y. I. Shokin summarizing recent Russian work on completely conservative difference schemes applied to conservation laws. Of the remaining, more narrowly focused, invited contributions, that by J. Fromm (IBM) offers a most impressive physical interpretation of numerical results for transition to turbulence in a flow between two discs with relative rotation. An interesting account on time-dependent instabilities and cellular structures in high-aspect-ratio, differentially heated cavities is given by Simkin (AT&T laboratories). Focusing on purely numerical issues, a paper by Cabannes (University of Paris), exposes an unusual approach to flow simulation, based on ideas from kinetic gas theory (e.g., momentum exchange by particle collision), and a contribution by Satofuka (Kyoto University) presents a block *explicit* solution methodology in which groups (blocks) of nodes are treated implicitly, while block-to-block coupling is handled explicitly, permitting an efficient vector–computer solution.

An attempt to classify contributed papers by topic or approach yields Reynolds-averaged NS applications as the largest group. There is the usual crop of k-ε-model applications to complex incompressible flows—around 3-D model buildings, in 3-D gentle bends, in a combustion-chamber model, around a 3-D car body, in a 2-D separated diffuser and in swirling flow—some performed, again as usual, with commercial CFD packages. Two papers report Reynolds-stress/flux-closure calculations, one relating to the challenging problem of describing the interpenetration of two fluids with very different densities, and the other concerned with a buoyancy-driven cavity flow. Other studies apply simpler mixing-length models or focus on laminar conditions in complex 3-D flows in a circular bend, an impinging jet in cross-flow and over wing geometries. A computational study by Lopez on multiple vortex breakdown in a ducted flow swirled by a rotating end-wall shows impressive and detailed agreement with flow-visualization experiments.

An examination of compressible-flow computations indicates an increasing tendency towards a full inclusion of viscous features. A couple of contributions report k-ε-model solutions for supersonic-nozzle flow and transonic-cascade flow. Further viscous-flow solutions are obtained for hypersonic re-entry type bodies and over subsonic, high M-number helicopter-rotor blades. An unusual study considers the interaction between a turbulent mean-flow field, computed with the k-ε-model, and acoustic-wave propagation. Two papers apply LES to transitional or stability-related features in a transonic shear layer and in