Preface

For nearly twenty years, the biennial *Symposium on Turbulent Shear Flows* has been held on university campuses around the world, beginning with the inaugural meeting at The Pennsylvania State University in 1977. For the 10th Symposium in August 1995 it was decided to return again to Penn State and there, over a period of three days, more than 200 papers were presented (selected from well over three hundred offered papers). From these contributions, some of the best have been invited to appear in this special Turbulent Shear Flows issue of the IJHFF.

In choosing the papers, the editors have intentionally kept the technical range as broad as was permitted by the normal scope of the IJHFF; only papers on combustion have thus had to be excluded. Nearly all the papers have undergone significant modification from the conference version, authors taking advantage of the opportunity to expand the coverage of their paper from what had been possible within the rigidly imposed conference page limit. In one case, papers by two different groups have, by that synergy that is often stimulated by successful conferences, now come together to form a seamless whole. All the submitted papers have undergone further review following standard IJHFF procedures, after which the authors have applied a final round of editing.

The first five papers in this issue present new experimental discoveries and results obtained from the application of modern measurement techniques. Obi et al. have used a new laser technique to measure the fluctuating velocity gradient near a channel wall. The whole-field measurement provided by particle-imaging velocimetry has been exploited to obtain both the turbulence statistics in the stagnation region of an impinging jet (Nishino et al.) and also the particle and fluid velocities in a particle-laden turbulent channel flow (Sato and Hishida). Laser-Doppler velocimetry measurements were obtained in turbulent near wakes of arrays of square blocks on a base plate (a model for LSI packages) by Okamoto et al., and of two tandem square cylinders in a square cross section duct by Devarakonda and Humphrey.

The seven papers which follow deal with one-point closures and their application to engineering problems. Abe et al. have developed a two-equation thermal turbulence model, derived from closure and truncation of the scalar-flux transport equation and have demonstrated its applicability in different types of free and wall shear flows. The paper by Speziale and Xu is concerned with the dynamic field and proposes a new strategy for handling strongly nonequilibrium flows with an explicit algebraic second-moment closure. The next two papers offer different schemes to account for near-wall effects on turbulence without introducing the usual wall-normal vectors or wall distance: the use of "invariant gradient indicators" by Craft and Launder and the "elliptic relaxation method" by Laurence et al. The other three papers in this group consider the numerical prediction of complex shear flows of engineering importance. Bosch and Rodi have successfully calculated the vortex shedding past a square cylinder fixed at various distances from a wall with a recently modified k-ε model. Second-moment closure has been adopted for the other two studies: Amano et al. have examined the unsteady flow through an axial turbine stage, while Elena and Schiestel have modeled the flow inside a shrouded rotor–stator system. These three applications convey an impression of the capabilities of current modelling strategies in simulating quite complex industrial flows.

The last six papers report numerical simulations; three large-eddy simulations (LES) and three direct numerical simulations (DNS). Lund and Moin simulated the boundary layer developing on a concave wall with the dynamic subgrid-scale (SGS) model and found reasonable agreement with the experimental data, but also appreciable sensitivity to the in-flow conditions. Different versions of SGS models have been employed and tested in the simulation of a plane jet injected into a cross flow (Jones and Wille), whilst an extended application of LES, based on the lattice-Boltzmann scheme, has been made for the flow in a baffled stirred tank reactor (Eggels). In the last three papers, DNSs have served as a novel numerical experiment, enabling the flow under study to be probed in great detail. Lamballais et al. have investigated the dynamics of coherent vortices in a rotating channel, while Coleman et al. have studied the physics of time-developing, nonequilibrium, three-dimensional boundary-layer flow created by imposing a spanwise shear. The issue closes with a paper of Satake and Kasagi, who have explored the effect of a thin near-wall layer damping the spanwise velocity component, a study made from the viewpoint of future development of control methodology using microelectromechanical systems.

It is our hope that this collection is seen to capture some of the best examples of today's research in turbulent shear flows.

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Int. J. Heat and Fluid Flow 17: 186, 1996

655 Avenue of the Americas, New York, NY 10010

0142-727X/96/$15.00
PII S0142-727X(96)00046-5