BUTTERWORTH HEINEMANN

Editorial

Most industrial problems in heat and mass transfer are related to turbulence. While the topic of turbulence has frequently been the focus of many specialized scientific conferences, its profound role in and impact on heat and mass transfer have often been dealt with almost marginally, just as one of many aspects and modes of transport phenomena. A reason for this may lie in our present lack of knowledge about turbulence, even in simple isothermal flows. Indeed, without prior clarification of some basic queries related to mechanical turbulent interactions, any attempt to establish physically sound correlations with heat and mass transfer may seem illusory and futile. However, recent developments in the theory of turbulence, experimental techniques, modeling, and direct numerical simulations have opened new prospects for understanding and resolving problems of turbulent heat and mass transfer. This was the major motivation for initiating a specialized meeting, "International Symposium on Turbulence, Heat and Mass Transfer," held from August 9 to 12, 1995, in Lisbon, which focused on aspects of turbulence research which are directly or indirectly related to heat and mass transfer problems. This meeting was also envisaged as a revival of the successful, but not followed up, Joint ICHMT/IUTAM Symposium on Structure of Turbulence, Heat and Mass Transfer, held in Dubrovnik in 1982.

This issue of the journal is devoted to the highlighted papers presented at the symposium in Lisbon. It contains 14 selected papers, which have been reviewed and substantially revised after the presentation at the Symposium. The selected papers reflect to a large degree the diversity in current research and major achievements in the field.

The first five papers deal with invaluable computational techniques, the direct and large-eddy simulations (DNS and LES), which complement experiments in providing the information about turbulence interactions, particularly in flows characterized by the coherent structures, which are still not fully accessible to the experimental techniques. Métais and Lesieur focus on the dynamics of coherent vortices in various thermally stratified and rotating turbulent fields using LESs, whereas Inoue et al. in their two-dimensional Navier-Stokes computations introduce periodic forcing to the wake around a circular cylinder for active flow control. The subsequent three papers report simulations of wall flows, i.e., a DNS of turbulent flow in a channel with streamwise-periodic injection and suction (Miyake et al.), a LES of a weakly compressible boundary layer over an adiabatic flat plate (Ducros et al.), and a LES of turbulent transport in impinging jets (Gao and Voke). A novel approach to the computation of turbulent scalar transport is presented by Eggels and Somers, who employed the Lattice Boltzmann scheme. The next review paper by Baughn presents the current endeavors and some novelties in applying liquid crystal method in studies of turbulent heat transfer. Although this technique has been used for some time for determining the local temperature and heat flux on solid surfaces, only recently has the method reached a stage of maturity which permits accurate calibration, and it has become a powerful tool in the research of surface heat transfer. The enhancement of turbulent heat transfer is the topic of the next four papers, starting with an extensive review of the role and effects of imbedded vortices in internal flows by Fiebig followed by experimental and numerical contributions dealing with specific aspects: heat transport in a channel flow obstructed with a square rib (Yao et al.), heat transfer from serrated surfaces (Obi et al.), and thermal wake from a rectangular heated wall-rib in a turbulent boundary layer (Mori et al.). The last three papers deal with single-point closure modeling and application to some industrially relevant problems of heat transfer. Yamamoto reports on further development of a split-spectrum-based multiple-scale second-moment closure, tested in several homogeneous nonequilibrium flows. Kenjereš and Hanjalić present the application of algebraic turbulence models to the computation of natural convection in concentric and eccentric horizontal annuli at transitional and higher Rayleigh numbers. The issue closes with a paper by Görres et al. who present the finite element computations and measurements of strongly swirling flow laden with pulverized coal particles in a realistic model of a typical industrial furnace.

These few selections chosen for this journal issue are by no measure the only archival contributions presented at the conference. Many among the more than 140 papers presented deserve this privilege. The lack of space and a desire to balance the contributions in a variety of topics covered imposed a severe restriction to the number of papers included in this issue. The editors hope, however, that many more papers will find their way to the readers through the monograph proceedings of selected papers, which will be published in parallel with this journal issue.

N. Kasagi
Editor-in-Chief
Department of Mechanical Engineering
The University of Tokyo
Tokyo, Japan

K. Hanjalić
Guest Editor
Faculty of Applied Physics
Delft University of Technology
Delft, The Netherlands

655 Avenue of the Americas, New York, NY 10010

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