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# Foreword

Many industrial flows involving heat (and mass) transfer occur at Reynolds numbers in the turbulent regime. Prominent examples include the thermal system management in gas turbines, nuclear reactors and re-entry vehicles, thermal inversion in the atmosphere, pollution dispersion in lakes and rivers, flows within the ducts and pipes of industrial plants, and mixed flows in tubular and batch chemical reactors, to mention a few.

A thorough understanding of flow and heat transfer phenomena in such applications will, no doubt, help improve the design and control of associated processes and equipment in both the industrial and natural environments. Experimental investigations of turbulent heat transfer phenomena are crucial to the understanding of their physics. Yet, it is not presently feasible to set up exhaustively thorough experiments to study the full range of turbulent heat transfer phenomena, taking into account all the effects that occur in the original environments. Consequently, it is necessary to study simpler, idealized experimental configurations in order to investigate the effects of major parameters, often taken one at a time.

Another reason why these simple experiments are required is that they provide data of known uncertainty for the validation of numerical models developed for the calculation of flow and heat transfer in considerably more complex systems. Upon validation, such calculation procedures can be applied to perform thermal system management calculations and other types of predictions. So proved, these calculation models could, in principle, be incorporated into relevant computer codes to help improve the design of industrial plants.

There are two components to turbulent heat transfer: momentum transfer and heat (scalar) transfer. For most industrial flows, these two components are strongly coupled, and a thorough understanding of each is required if turbulent heat transfer is to be modeled accurately. Much work has been carried out on the investigation of momentum transfer in the absence of heat transfer or where forced-convection dominates. Consequently, the effects of external body forces, besides that due to buoyancy, on turbulent momentum transfer are relatively well understood.

On the other hand, work on convective heat transfer has seldom given enough attention to the role of momentum transfer. In the past, there have been limited interactions between investigators of momentum transfer and investigators of heat transfer. This is also true of those who have carried out experimental work and those who have performed modeling studies of heat transfer problems. Even though there have been numerous separate conferences on fluid mechanics and heat transfer in the past, the dialogue between these two groups of researchers, and a forum for the dialogue, have not been firmly established. One consequence of this has been an unacceptable delay in the transmission of turbulent heat transfer knowledge and technology applicable to the industry and the environment.

The Engineering Foundation Turbulent Heat Transfer Conference, held in San Diego on March 10–15, 1996, aimed to bring together different groups of researchers in turbulent heat transfer to help cultivate a meaningful and continuing dialogue among them. Various groups of researchers were invited. They included, but were not limited to, experimentalists in fluid mechanics and heat transfer, turbulence modelers, numerical experts, and researchers specializing in technology transfer. This diverse group of researchers met together for 5 days to discuss present and future research directions in the areas of: (1) momentum transport modeling; (2) scalar transport modeling; (3) heat transfer in near-wall flows; (4) heat transfer in homogeneous flows; (5) heat transfer in complex flows; (6) mixed/natural convection; (7) separated and impinging flow with heat transfer; (8) transitional flow with heat transfer; and (9) new experimental techniques. These topics were selected because of their relevance to a wide variety of industrial and environmental problems.

Because of the timeliness and success of the Conference, and because of the high quality of the contributions, the Organizing Committee decided to arrange for archive publication of a limited number of peer-reviewed papers in one Special Issue of the *International Journal of Heat and Fluid Flow*. The Special Issue contains 17 papers, selected from among the many presented at the Conference. They are representative of the various topics discussed and provide in-depth coverage of their subject areas. It is our expectation that publication of these papers will continue to promote a sustained and lively discussion of these and related turbulent heat transfer topics.

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