Emerging Topics in Heat Transfer

Enhancement and Heat Exchangers

EDITORS
Qiuwang Wang,
Yitung Chen &
Bengt Sundén

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International Series on Developments in Heat Transfer

Objectives

The Developments in Heat Transfer book Series publishes state-of-the-art books and provides valuable contributions to the literature in the field of heat transfer, thermal and energy engineering. The overall aim of the Series is to bring to the attention of the international community recent advances in thermal sciences by authors in academic research and the engineering industry.

Research and development in heat transfer is of significant importance to many branches of technology, not least in energy technology. Developments include new, efficient heat exchangers, novel heat transfer equipment as well as the introduction of systems of heat exchangers in industrial processes. Application areas include heat recovery in the chemical and process industries, and buildings and dwelling houses where heat transfer plays a major role. Heat exchange combined with heat storage is also a methodology for improving the energy efficiency in industry, while cooling in gas turbine systems and combustion engines is another important area of heat transfer research. Emerging technologies like fuel cells and batteries also involve significant heat transfer issues.

To progress developments within the field both basic and applied research is needed. Advances in numerical solution methods of partial differential equations, turbulence modelling, high-speed, efficient and cheap computers, advanced experimental methods using LDV (laser-doppler-velocimetry), PIV (particle-image-velocimetry) and image processing of thermal pictures of liquid crystals, have all led to dramatic advances during recent years in the solution and investigation of complex problems within the field.

The aims of the Series are achieved by contributions to the volumes from invited authors only. This is backed by an internationally recognised Editorial Board for the Series who represent much of the active research worldwide. Volumes planned for the series include the following topics: Compact Heat Exchangers, Engineering Heat Transfer Phenomena, Fins and Fin Systems, Condensation, Materials Processing, Gas Turbine Cooling, Electronics Cooling, Combustion-Related Heat Transfer, Heat Transfer in Gas-Solid Flows, Thermal Radiation, the Boundary Element Method in Heat Transfer, Phase Change Problems, Heat Transfer in Micro-Devices, Plate-and-Frame Heat Exchangers, Turbulent Convective Heat Transfer in Ducts, Enhancement of Heat Transfer, Transport Phenomena in Fires, Fuel Cells and Batteries as well as Thermal Issues in Future Vehicles and other selected topics.

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Preface

Advances in high temperature equipment continue to be important because involved heat transfer and related phenomena are commonly of a complex nature and different mechanisms like heat conduction, convection, turbulence, thermal radiation and phase change as well as chemical reactions may occur simultaneously. In addition operating problems like fouling, corrosion and mechanical loading might be severe. Typically, applications are found in heat exchangers, gas turbine cooling, turbulent combustion and fires and combustion engines. Heat transfer might be regarded as an established and mature scientific discipline, but it is playing a major role in new emerging areas such as sustainable development and reduction of greenhouse gases as well as for micro- and nano-scale structures and advanced gas turbines and heat exchangers. In engineering design and development, reliable and accurate computational methods are requested to replace or complement expensive and time consuming experimental trial and error work. Tremendous advancements in knowledge and competence have been achieved during recent years due to improved computational solution methods for non-linear partial differential equations, turbulence modeling advancement and developments of computers and computing algorithms to achieve efficient and rapid simulations. Nevertheless, to enable further progress in computational methods for complex problems of engineering significance, developments in theoretical and predictive procedures – both basic and innovative – are needed. In addition, accurate experimental investigations are needed to provide reliable data and to validate the computational methods.

This book contains ten edited chapters encompassing important emerging topics in heat transfer equipment, particularly heat exchangers. The chapters have been selected by invitation only. All the chapters have been reproduced directly from material submitted by the authors but an attempt has been made to use a unified outline and methods of presentation for each chapter.

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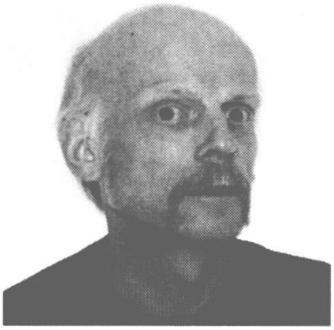
Qiuwang Wang, Yitung Chen and Bengt Sundén
Xi'an, Las Vegas and Lund

About the Editors

Dr. Qiuwang Wang received a B.Sc. in Fluid Machinery from Xi'an Jiaotong University, China, in 1991 and a Ph.D. degree in Engineering Thermophysics from the same university in 1996. He then joined the faculty of the university. He is now a full professor at the School of Energy and Power Engineering, Xi'an Jiaotong University where is actively involved in both teaching and research in heat transfer. He is a member of several committees, editorial boards and various professional societies. He has given many invited talks worldwide. He has supervised more than 60 PhD or master students. He has also been author or co-author of 4 books and more than 150 journal papers, about half of which are in international journals. He has obtained 15 China invent patents and one US patent.

Dr. Yitung Chen received his Ph.D. degree in mechanical engineering at University of Utah, Salt Lake City, Utah in 1991 after obtaining his M.S. in 1988 from the same school. His B.S. received in 1983 is in chemical engineering from Feng Chia University, Taichung, Taiwan. Since 1994 he has been affiliated with the Department of Mechanical Engineering, University of Nevada, Las Vegas where he was promoted to full professor in 2009. His academic and industrial experiences in numerical and experimental fluid mechanics and thermal-fluid sciences cover multidisciplinary areas of mechanical, biomedical, environmental, chemical, and nuclear engineering. Dr. Chen is an expert in computational and experimental aspects of momentum, heat, and mass transfer. He is a fellow of ASME. Dr. Chen has over the last six years published more than 50 journal papers and more than 100 conference papers in a wide variety of topics. In addition, he has co-authored a monograph, book chapters and technical reports.



Bengt Sundén received his M.S. in 1973, Ph.D. in thermodynamics and fluid mechanics in 1979, and docent in applied thermodynamics and fluid mechanics in 1980, all from Chalmers Universities of Technology, Goteborg, Sweden. He became Professor of Heat Transfer in 1992 at Lund University. Since 1995 he serves as the head of the Department of Energy Sciences, Lund University, Sweden. His research topics are enhancement of heat transfer in compact heat exchangers, computational methods of convective flow and heat transfer in complex narrow geometries, combustion-related heat transfer including thermal radiation, gas turbine heat transfer (impinging jets, film cooling, ribbed ducts), evaporation and condensation in plate heat exchangers, thermal imaging techniques, PIV, and multiscale and multiphysics transport phenomena in fuel cells. He has published more than 500 journal papers, books, and proceedings. He has also delivered many keynote and invited lectures. He has been editor of 25 books published by international publishing houses and author of two textbooks (one in Swedish, one in English). He is involved in referee tasks for more than 40 international journals and has been active in several international and organizing committees and boards. He is also editor-in-chief for a book series, Developments in Heat Transfer (also published by WIT Press). In addition, he is active editor for four journals. He is a fellow of the ASME and a 2011 recipient of the ASME Heat Transfer Memorial Award.

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