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Review

Heat transfer—A review of 2005 literature

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ABSTRACT

The present review is intended to encompass the heat transfer literature published in 2005. While of a wide-range in scope, some selection is inevitable. We restrict ourselves to papers published in English through a peer-review process, with selected translations from journals published in other languages. Papers from conference proceedings generally are not included, though the Proceeding itself may be cited in the introduction. A significant fraction of the papers reviewed herein relates to the science of heat transfer, including experimental, analytical and numerical studies. Other papers cover applications where heat transfer plays a major role, not only in man-made devices but in natural systems as well. The papers are grouped into major subject areas and then into subfields within these areas. In addition to reviewing the literature, we mention major conferences held in 2005, major awards related to heat transfer presented in 2005, and books on heat transfer published during the year.

Contents

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1. Introduction

As in previous years, a considerable effort has been devoted to research in traditional applications such as chemical processing, general manufacturing, and energy conversion devices, including general power systems, heat exchangers, and high performance gas turbines. In addition, a significant number of papers address topics that are at the frontiers of both fundamental research and important emerging technologies, including nanoscale structures, microchannel flows and bio-heat transfer.

The present review considers the heat transfer literature published in 2005. While intending to be exhaustive, some selection is inevitable. We restrict ourselves to papers published in English language through a peer-review process, with selected translations from journals published in other languages also having been included. The papers are grouped into separate subject related sections and then into subfields within these sections. In addition to reviewing the literature, we mention major heat transfer related conferences, major awards and books on heat transfer published during the year.

The International Center for Heat and Mass Transfer organized SPRAY'05, the International Symposium on Heat and Mass Transfer in Spray Systems, in Antalya, Turkey from 5 to 10 June. Sessions addressed turbulence effects on interfacial phenomena, vaporization, combustion, droplet impact on heated surfaces, and spray cooling. The ASME Turbo Expo was organized by the International Gas Turbine Institute from 6 to 9 June in Reno, USA. The Heat Transfer Division conducted numerous sessions with a focus on heat transfer effects related to laminar-turbulent transition, internal air systems and seals, and combustion. At INTERPACK'05 held in San Francisco, USA from 17 to 22 July, several sessions were held on thermal management of micro-electronic and photonic systems, microscale heat transfer phenomena in electronics, thermal interface materials, heat pipes, and data center cooling. At a conference on Interdisciplinary Transport Phenomena in Microgravity and Space Sciences held in Tomar, Portugal from 7 to 12 August, papers were presented on topic including but not limited to thermophysical property measurements, diffusion effects in crystal growth, boiling, biotransport phenomena, and interfacial phenomena. The International Solar Energy Conference from 6 to 12 August included sessions on ocean thermal power, solar ponds, and solar thermal power. The Fifth International Conference on Enhanced, Compact, and Ultra-Compact Heat Exchangers held from 11 to 16 September in Whistler, Canada discussed fundamental studies in single- and multi-phase flow, design data and methodology, and micro-heat exchangers. A meeting on Heat Transfer Fluid Flow at the Microscale was organized in Barga, Italy on 25–30 September. Topics covered included measurement techniques, two-phase flow in microchannels, microfluidic systems and molecular dynamic simulations. At the International Mechanical Engineering Congress and Exposition (IMECE) held on 5–11 November in Orlando, USA, sessions on heat transfer discussed various topics including gas–liquid and phase-change flows at the microscale, heat pipes and property estimation.

The 2004 Max Jakob Memorial award was presented to Dr. V.K. Dhir for his pioneering work in the fundamentals and applications of boiling heat transfer, such as his contributions to the study of boiling in microgravity, and cooling of high heat flux devices. The 2005 Heat Transfer Memorial Awards were conferred on A. Haji-Sheikh (Science), M. Modest (Art), and Wei Shyy (General). The Donald Q. Kern Award for 2004 was given to Dr. Ramesh K. Shah at the Summer Annual Heat Transfer Conference, San Francisco, USA on July 19, 2005.

Books pertaining to heat transfer which were published in 2005 are the following:

Heat Transfer and Fluid Flow in Minichannels and Microchannels
S. Kandlikar, D. Li, S. Garimella
Elsevier

The Equations of Radiation Hydrodynamics
G.C. Pomraning
Dover Publications

Finite Element Method: Applications in Solids, Structures, and Heat Transfer
M.R. Gosz
Marcel Dekker
Thermo-fluid Dynamics of Two-Phase Flow
M. Ishi, T. Hibiki
Springer-Verlag, New York

Transport Phenomena in Porous Media, Volume III
I. Pop, D.B. Ingham
Elsevier

Thermal Food Processing: New Technologies and Quality Issues
D.-W. Sun
CRC Press

Computational Methods for Heat and Mass Transfer
P. Majumdar
Taylor & Francis

Heat Transfer Calculations
M. Kutz
McGraw-Hill