

FUNDAMENTALS OF MICROSCALE HEAT TRANSFER: BOILING, CONDENSATION, SINGLE- AND TWO-PHASE FLOWS

A Five Day Short Course in Lausanne, Switzerland (June 11-15, 2012)

Course Host: Heat Transfer Research Inc. (HTRI)
150 Venture Drive
College Station, Texas 77845, USA

COURSE DESCRIPTION

In response to the numerous evolving technologies and applications based on microscale flow and heat transfer, the present course has been developed to provide a broad, fundamental state-of-the-art review on this emerging topic. The course provides a comprehensive treatment of both single-phase flow and heat transfer and two-phase flow and heat transfer in microchannels. The course is directed to heat transfer specialists in the computer and electronics cooling industries, the automotive and the air-conditioning industries, the aerospace industry, and the micro- and compact heat exchanger industries. Furthermore, the course is addressed to Ph.D. students and post-doctoral researchers involved in this area of research. The course lecturers are internationally recognized experts in micro-scale (and macro-scale) research and applications. The course format is informal with significant interaction during and after the lectures.

COURSE LECTURERS

John R. Thome (*Course Coordinator and Lead Lecturer*) is Professor of Heat and Mass Transfer at the Swiss Federal Institute of Technology in Lausanne (EPFL), Switzerland, where his research interests are two-phase flow and heat transfer in microscale and macroscale processes. He received his Ph.D. at Oxford University (1978) and ran his own international engineering consulting company from 1984-1998. He is the author of three books and received the ASME Heat Transfer Division's Best Paper Award in 1998 for his work on flow boiling heat transfer and the UK IOR J&E Hall Gold Medal (2008) for his work on refrigeration heat transfer. He has published extensively on boiling and two-phase flow in microchannels and micro-evaporators. He will lecture on two-phase flow and heat transfer.

Bruno Michel (*Invited Lecturer*) is Mgr. of Advanced Thermal Packaging at IBM Zürich Research Laboratory. He received his Ph.D. in bio-chemistry/biophysics from the University of Zürich in 1988 and then joined the IBM, where he later started the Advanced Thermal Packaging group in 2003 on improved thermal interfaces and better miniaturized convective cooling. Main current research topics of the Zürich group are microtechnology/microfluidics for efficient chip and data center thermal management, hybrid liquid/air coolers, 3D packaging and thermophysics to understand heat transfer in nanomaterials and structures. He will speak on the state-of-the-art of computer cooling technologies.

Iztok Zun (*Lecturer*) is Professor and Head of the Laboratory for Fluid Dynamics and Thermodynamics, Faculty of Mechanical Engineering, University of Ljubljana, Slovenia. He received his Ph.D. at the University of Ljubljana (1976) and the JSMF Award in 2003. He has a very distinguished

international reputation on transient characteristics and multi-scale modeling of two-phase flows for a wide range of two-phase processes and their industrial application. He is working on visualization and modeling of two-phase flows in headers of multi-microchannel elements, elongated bubble flows and bubble coalescence. He will lecture on the numerical simulation of single-phase microchannel cooling elements and the status of numerical techniques for two-phase flows in microchannels of simple and complex geometry.

Gian Piero Celata (*Lecturer*) is Director of the Division of Advanced technologies for energy and industry at the Italian national research center ENEA and is honorary chair of the European Two-Phase Flow Group among his many international appointments. He received his Ph.D. at the University of Rome (1980) and the JSMF Award in 2003. He is a world expert on measurement and prediction of critical heat fluxes and has in recent years done extensive research on single-phase flow and boiling heat transfer in microchannels, including work at zero gravity and on heat pipes. He is also very well known for the numerous international research conferences he has organized and chaired and he has edited numerous books. He is a Member of the European Academy of Sciences and Arts. He will focus his lectures on the state-of-the-art of single-phase heat transfer and fluid flow in simple and complex geometries and on condensation and boiling heat transfer in microchannels.

Anthony M. Jacobi (*Lecturer*) is Kritzer Distinguished Professor of the Department of Mechanical Science and Engineering at the University of Illinois Champaign-Urbana and is Co-director of the Air-Conditioning and Refrigeration Center (ACRC) with 30 industrial sponsors. He received his Ph.D. from Purdue University (1989) and is widely known for his research on microscale heat transfer (he is co-author of the 3-zone flow boiling model with J.R. Thome). He is a leading world expert on air-side heat transfer in compact heat exchangers. His lectures will focus on air-side heat transfer of compact heat exchangers, including the best prediction methods for heat transfer and pressure drop, flow visualization results, heat transfer enhancement and evaluation methods, frost formation and condensate retention effects, and emerging methods to manage condensate during simultaneous heat and mass transfer.

Heat Transfer Research Inc. (*Host*) is a well-known industrial research and development consortium founded in 1962 with over 600 member companies from around the world and extensive experience in training (www.htri.net).

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