Boiling and Condensation: Theory and Applications

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Overview

Many engineering problems involve boiling and condensation which are essential to all closed-loop power and refrigeration cycles. Today, boiling is also used to cool electronic equipment, such as supercomputers, laptop computers, and mobile phones. Evaporators and condensers are also essential components in vapour compression refrigeration cycles. To design such components requires that the associated phase change processes are well understood. This course introduces the participants to the theory and applications. First part of the course gives a solid grounding in the theory and the second part will expose the students to the practical applications, such as (i) next generation supercomputer and data-center cooling, (ii) principles and applications of heat pipes, (iii) reduced air-side thermal resistance for fin-tube bundles towards significantly reducing cost and size of heat recovery steam generators (HRSGs) in modern combined cycle power plants (CCPPs), and (iv) actively-and-passively reduced air-side thermal resistance for fin-tube bundles that make air-cooled condensers attractive for deployment of thermal power plants in water scarce regions. With this as a motivation, the course deals with science and engineering for relevant theory, modelling, experiments, and system design issues. The tutorials will enhance the understanding of the existing science and technology of boiling and condensation.

Objectives

The primary objectives of the course are: (i) To introduce the students to the theory of pool boiling, flow boiling and, laminar and turbulent film condensation; (ii) To expose the participants to the fundamentals of the critical need areas in waste heat management and recovery; (iii) To build confidence and capability of participants with the up to date science and engineering knowledge relevant to the operation of milli-meter and larger-scale flow boilers and flow-condensers and, also, air-side flows across finned-tube bundles associated with the larger scale uses of these devices; (iv) To provide exposure to practical problems and their solutions, through case studies and projects in the tutorial sessions; (v) To enhance a strong science and education backed innovation capability of the participants in the identified areas of critical need.

Modules	**A: Theory (Instructor: Prof. P.S. Ghoshdastidar): September 6 - September 9, 2016** **B: Applications (Instructor: Prof. Amitabh Narain): September 10 - September 14, 2016** **Number of participants for the course will be limited to forty.**
You Should Attend If…	▪ you are faculty members and Master's/Ph.D students from universities, colleges and institutes in India and abroad ▪ you are engineers employed with Industry in India and abroad ▪ you are scientists working in R & D departments of research labs in India and abroad
Fees	The participation fees for taking the course are as follows: **Participants from abroad : US $500** **Industry/ Research Organizations: Any of the two modules: Rs. 20000/-** **Both modules: Rs. 30000/-** **Academic Institutions:** **Both modules: Rs. 10000/-** The above fees include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility. The participants will be provided with accommodation on payment basis in the institute guest house.

The Faculty

Prof. Amitabh Narain (Ph. D., University of Minnesota, 1983) is Professor in the Department of Mechanical Engineering at Michigan Technological University, USA; a Fellow of the ASME; an Associate Editor of the *Journal of Heat Transfer*; and Director of the Energy-Thermo-Fluids area in his department. His current research deals with state-of-the-art computational and experimental techniques for single-phase and phase-change (flow boiling and flow condensation) flows, particularly those related to energy technologies and thermal management. Dr. Narain has authored over 73 peer-reviewed articles. His research accomplishments have been highlighted through several keynote and invited lectures – including US websites such as by NSF in 2012 and by Research.Gov in 2013. He is active in teaching and mentoring students (graduate and undergraduate). Dr. Narain has served on several government panels and on ASME committees. Over the past twenty years, he has also been an active lead organizer for several symposia, topics, or sessions for ASME and other international conferences.

Prof. P.S. Ghoshdastidar is Professor in the Department of Mechanical Engineering, Indian Institute of Technology Kanpur. He obtained his Ph.D degree from the University of South Carolina, Columbia, U.S.A. in 1984. Dr. Ghoshdastidar has over thirty one years of teaching and research experience at IIT Kanpur. His area of specialization is Computational Heat Transfer. His current research interests are: rotary kiln modeling, electronic and optonic cooling, Non-Newtonian flow and heat transfer, and single-phase and boiling heat transfer in nanofluids. Over last several years Dr. Ghoshdastidar has been actively engaged in the field of computational modelling of heat transfer in nanofluids. His research group was the first to numerically simulate pool boiling of nanofluids. He has published 95 research papers in refereed journals and conference proceedings. He has authored three books. Since May 1, 2011 he is Associate Editor of *Heat Transfer Research*, an international journal published by Begell House, Inc., U.S.A.

Course Co-ordinator

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