

# **Overview of Fundamentals and Applications of Multiphase/Multicomponent Flow and Heat Transfer**

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## **Abstract**

Multiphase and/or multicomponent flows include a variety of material and state compositions, such as: liquid/liquid, liquid/gas (or liquid/vapor), liquid/solid-particles, gas/solid-particles, and gas/liquid/solid. Their applications encompass a wide range of industries, to mention only; pharmaceutical, computer technology, chemical plants, thermal power plants (fossil, nuclear and solar), oil recovery and transport, metallurgy, automotive and aerospace.

System configurations and operating conditions extend from very small (such as microtubes) to very large (boilers, nuclear reactors, chemical bubble columns) scales, and from atmospheric to nearly-critical pressures. The complexity of the underlying physics makes multiphase science a challenging field from both the experimental and theoretical perspectives.

The objective of the seminar is to give an overview of major theoretical concepts behind multiphase fluid mechanics and heat transfer, the latter focusing on the effect of phase change (boiling or/and condensation). The main physical principles will be discussed governing the interfacial phenomena between the individual flow components. Also, major modeling concepts at various spatial scales and levels of detail will be introduced. Typical results of computer simulations and their comparisons against experimental data will be shown. Finally, selected examples will be presented illustrating practical industrial problems.

## **Biographical Information**

Dr. Michael Podowski is Professor of Nuclear Engineering and Engineering Physics in the Department of Mechanical, Aerospace and Nuclear Engineering at Rensselaer Polytechnic Institute, and Director of Center for Multiphase Research. He is a former head of the Department of Nuclear Engineering and Engineering Physics. He has also served as director of the DOE-sponsored University Consortium for the Deployment of a Suite of High Performance Computational Tools for Multiscale Multiphysics Simulations of Generation-IV Reactors. Main research interests of Dr. Podowski are in the following areas: fundamentals and applications of multiphase flow and heat transfer, computational multiphase fluid dynamics (CMFD), supercritical-pressure turbomachinery and systems, dynamics and stability of multiphase systems, and nuclear reactor thermal-hydraulics and safety. He has over 350 technical publications, including 7 books/book-chapters and 60+ journal papers. He is Fellow of the American Nuclear Society (ANS) and recipient of the 2014 ANS Compton Award.