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On the mechanistic modeling of fluid flow and heat transfer in supercritical-pressure systems

Supercritical fluids are very promising materials for a variety of energy systems. The fluids under consideration include water and carbon dioxide, with the latter being of particular interest for future clean energy technologies. The objectives of this lecture are to discuss the progress in the computational modeling of fluid flow and heat transfer in supercritical-pressure systems using the above-mentioned fluids. Several issues of significant theoretical and practical interest will be discussed, including: challenges in the modeling of forced-convection heat transfer imposed by the effect of property variations on turbulence at slightly supercritical pressures and on the associated system dynamics, the analysis of similarities between the properties of water and carbon dioxide and the physical and computational aspects of modeling high-velocity supercritical carbon dioxide (SC-CO_2) flow inside the complex geometry of rotating machinery, accompanied by high pressure changes. Selected results of computer simulations will be shown using one-dimensional and multidimensional models. They will include both model validation against experimental data and practical applications to predict the hydrodynamic and thermal characteristics of supercritical-pressure systems.

Biography

Michael Z 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. His research interests include 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 American Nuclear Society (ANS) and recipient of the 2014 ANS Compton Award.

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