

Nuclear Engineering Seminar

Dr. Suneet Singh,

Fulbright Kalam Climate Fellow, Professor-IIT Bombay

Wednesday, October 23, 2024

3:30 pm | MATH 175

Bifurcation Analysis of Two-phase Flow Instabilities

Abstract

The two phase flows in heated channels show different types of instabilities which includes flow excursions and flow oscillations. It is well known from past studies that these systems exhibit rich dynamics and that the phenomena are highly complex. Even though the system has been studied as a non-linear dynamical system before, the process has been made simpler with the advent of bifurcation tools like MATCONT. Using these tools, one can divide the large parametric spaces into regions which show different dynamics. Furthermore, different instabilities can be identified as distinct kinds of bifurcations using this approach. Bifurcation analysis is used to examine two-phase flow instabilities in three systems: two-phase flow in a channel with compressible volume, two-phase flow in parallel channels, and two-phase flow in a natural circulation loop. The phase-space plots in the pressure drop-mass flow rate plane are used to provide an explanation of the interaction of different types of bifurcations.



Dr. Suneet Singh is currently Fulbright Kalam Climate Fellow at Purdue University and Professor at the Department of Energy Science and Engineering at IIT Bombay. Previously, he was Head of the Department. He worked as a post-doctoral fellow at INL in the United States before coming to IIT Bombay. He received a Ph. D. in Nuclear Engineering from the University of Illinois in Urbana- Champaign, USA, Master's in Nuclear Engineering and Technology from IIT Kanpur, and his BS at the Maulana Azad National Institute of Technology. His broad research area includes nuclear reactor thermal-hydraulics and solar thermal. The specific focus of his research is in efficient numerical techniques for neutron diffusion and fluid flow. Along with this, he has been investigating bifurcations in a number of systems, including nuclear reactors, nuclear coupled thermal hydraulics, two-phase flows, and supercritical fluids. He was awarded Bhaskara Advanced Solar Energy (BASE) fellowship by the Indo-US Science and Technology Forum (IUSSTF). He also received the S. P. Sukhatme Award for Teaching Excellence at IIT Bombay. He served as guest editor for a special issue of Progress in Nuclear Energy on nuclear reactor stability. He has over a hundred papers published in peer-reviewed journals. During his fifteen-year academic career, he has graduated 25 PhD students and more than 60 Masters students.