Nuclear Safety- An Interdisciplinary Research

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Abstract

Nuclear safety is a very broad field of research which requires critical solutions from several disciplines of engineering and science. After Fukushima there is a daunting task for us to ensure the safe interaction of nuclear systems with the environment. In order to continue building more nuclear power plants to satisfy world’s energy needs, it is essential to have solutions for making nuclear facilities passively safe in all circumstances. The advances in nuclear fuel cycles and safe nuclear waste storage are only possible if safety envelopes are well-known.

This seminar will highlight several challenges faced by nuclear industry on safe operation of the existing nuclear power plants. One of such critical problems is the deposition of corrosion products on nuclear fuel and their negative impact on reactor neutronics leading to fuel failures. This research work developed multi-physics experimental and computational methods to understand, model and mitigate such issues during last few years. These problems also necessitated the development of a new neutronics code which can be coupled with other mesoscopic transport models. Recently, Lattice Boltzmann method was developed to solve linear Boltzmann equation for neutron or radiation transport. The use of Lattice Boltzmann method for neutronics ensures integral coupling with other continuum or mesoscopic transport processes in a single frame-work and can provide advanced nuclear safety codes for better risk quantification. The system level approach to evaluate the performance of next generation passive safety designs for nuclear systems will be discussed.

Bio Sketch

Dr. Hitesh Bindra started his career as a Nuclear Reactor Engineer after his undergraduate education in Chemical Engineering from Panjab University, India. He worked for nuclear power plants and projects for few years in India and then moved to University of Illinois to pursue graduate studies. At Illinois, he did masters and doctoral research under supervision of Prof. Barclay Jones. His doctoral dissertation was related to understanding the crud deposition on nuclear fuels in light water reactors. In this work he coupled colloidal science with boiling phenomenon for modeling the transport and attachment of crud. During his PhD, Dr. Bindra also worked with Caterpillar Simulation Center on modeling material processes. After completion of his PhD thesis, he started post-doctoral work at CUNY Energy Institute on several energy system concepts and has contributed in development of pilot scale experimental test facilities. He is currently involved in the examination of new nuclear reactor concepts and their behavior in accident-like conditions. He has several publications and inventions in the field of energy. He has developed advanced computational methods for solving nuclear engineering problems.