Empowering Predictive Simulation of Complex Nuclear Systems via Rigorous Characterization of Uncertainties

Hany Abdel-Khalik
Associate Professor
Purdue University

Wednesday, October 14

4:00 pm

Hill Hall 202

Abstract: The ultimate objective of the DOE's advanced modeling and simulation initiative is to make high-fidelity predictions that support the design and operation of a wide range of reactor simulation. With such improvements on the simulation front, a similar improvement in the practices of uncertainty characterization is needed in order to assess the reliability of toolkit's predictions and their extrapolation to the application domain. Reliability indicates the ability to produce, in both steady state and transient simulations, predictions that are accurate, robust, and useful in capturing key physical phenomena governing reactor behavior. Uncertainty characterization indicates the ability to identify, propagate, and prioritize sources of uncertainties, and their reliable mapping to a wide range of operating conditions, including the mapping of experimental biases from the experimental domain to the application domain. This presentation will overview our recent developments in the areas of reduced order modeling required to render a computationally efficient and reliable characterization of uncertainties in nuclear reactor simulation.

Biography: Dr. Abdel-Khalik is a computational scientist focusing on the development of methods and algorithms for order reduction and uncertainty characterization in complex engineering systems, such as nuclear reactors. He won the Henry/Greebler Graduate Scholarship twice as a doctoral student, and earned his Ph.D. in 2004 in nuclear engineering from North Carolina State University. Immediately following graduation he worked as a nuclear engineer for AREVA-NP in the neutronics methods group, where he focused on developing methods for fuel management optimization. In 2007, he joined the faculty at North Carolina State University, and was promoted to Associate Professor in 2013. He is currently an Associate Professor at Purdue University, School of Nuclear Engineering. Since 2011 his group has won five awards from the Reactor Physics Division of the American Nuclear Society for best paper or poster, and one of his students also won the Mark Mills award for best paper advancing science and engineering related to the atomic nucleus.