Incident Flux Response Expansion Theory for Core Neutronics, Radiation Detector & Radiotherapy Calculation

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The most accurate neutron, photon and coupled photon electron calculation methods available, known as Monte Carlo methods, require long computation times, making them impractical for their intended use such as whole-core neutronics analysis, detector calculation, and radiotherapy treatment planning, respectively. Methods currently used make approximations that sacrifice accuracy for speed, potentially leading to increased margins in core design and reduced effectiveness in special nuclear materials detection and radiotherapy treatment. In this seminar, a new hybrid radiation transport method, called COMET or IFLEX, will be presented that is fundamentally different than the current stochastic and deterministic transport methods and their low order (e.g. diffusion theory) approximations. The new method will be compared to direct Monte Carlo methods using stylized benchmark problems typical of an operating CANDU-6 core, a CsI(Na) detector, and a lung CT scan. The results of these comparisons will demonstrate that the new method is capable of accuracy comparable to Monte Carlo methods while achieving substantially reduced computation times.

Since July 2002, Dr. Rahnema’s responsibility at Georgia Institute of Technology has included research, teaching, and administration of the Nuclear and Radiological Engineering & Medical Physics (NRE/MP) Programs. He is currently Professor and Chair of the NRE/MP Programs in the George W. Woodruff School. He also has an appointment as an Adjunct Professor of Radiation Oncology at the Emory University School of Medicine since 2005.

Dr. Rahnema received his PhD in nuclear engineering from the University of California–Los Angeles (UCLA) in 1981. He joined Georgia Tech in October 1992. From 1981 to 1992, he was at General Electric Nuclear Energy’s nuclear methods development group. His responsibility included GE’s 3-D Nuclear/Thermal Hydraulics BWR Core Simulator PANACEA used for design, monitoring and prediction of BWR cores.

Dr. Rahnema is a Fellow of the American Nuclear Society (ANS) and Chair of the Honors and Award Committee of the ANS Mathematics and Computation Division (MCD). He is a past Chair of the MCD (2 times), the Reactor Physics Divisions (RPD) and the founding Chairman of the Board of Directors of the Southeast Universities Nuclear Reactors Institute for Science and Education (SUNRISE).

Dr. Rahnema is a finalist for position of Jerry and Tina Grandey University Chair in Nuclear Science and Engineering