SCALE Training Course:

Advanced Sensitivity and Uncertainty Analysis Techniques for Criticality Code Validation

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OECD Nuclear Energy Agency
Issy- les-Moulineaux, France

The TSUNAMI sensitivity and uncertainty analysis techniques available in SCALE 6.0 provide the ability to quantify biases and uncertainties for applications that are problematic under traditional techniques, such a fission product burnup credit.

With TSUNAMI, the sensitivity of k_{eff} to the energy-dependent, nuclide-reaction specific cross-section data are computed in explicit 3D geometry with the KENO V.a and KENO-VI Monte Carlo codes. Using SCALE's comprehensive cross-section-covariance data library, the uncertainty in k_{eff} due to each nuclide and reaction can be quantified. The uncertainty quantification can serve as a bounding value for the computational bias introduced by each nuclide in a given system. TSUNAMI also provides tools to quantify the similarity of benchmark experiments to safety applications using correlation coefficients (c_k) as well as nuclide-reaction-specific measures.

New for SCALE 6.0, computational biases can be quantified with the generalized linear least squares tool TSURFER. TSURFER can assimilate biases quantified from many different types of benchmark experiments, which may each contribute a specific validation component of the safety application. Furthermore, data from reactivity or replacement experiments can be emphasized with the new TSAR tool. The combination of TSURFER and TSAR provide a mechanism to extract biases due to test materials in reactivity experiments and project them to biases in a safety application.

This advanced 2-day course will focus on the theory and application of uncertainty analysis and the use of TSURFER and TSAR to quantify biases with k_{eff} and reactivity experiments. Prior experience with TSUNAMI and the SCALE code system is recommended.