1046-90-666 **Oleg Roderick*** (roderick@mcs.anl.gov), **Mihai Anitescu** and **Paul Fischer**. *Uncertainty Quantification: Improved Stochastic Finite Element Approach.*

We introduce a stochastic finite element-based approach to describing the uncertainty of a complex system of differential-algebraic equations with random inputs.

For our test system, we take a 3-dimensional steady-state model of heat distribution in the core of a nuclear reactor. The dependence of the material properties of the reactor on temperature includes uncertainty.

We solve the corresponding problem of uncertainty quantification through the creation of a valid simplified version of the system. We construct this surrogate model as a goal-oriented projection onto an incomplete space of interpolating polynomials; find the coordinates of the projection by collocation; and use derivative information to reduce the number of the required collocation points. The basis is trimmed to linear functions in some variables, and extended to high order polynomials in the others, depending on relative importance. Derivatives of the output with respect to random parameters are obtained using an adjoint method with elements of automatic differentiation.

The resulting model is more computationally efficient that random sampling, or generic stochastic finite element method; and has significantly greater precision than linear models. (Received September 09, 2008)