UNIVERSITY of HOUSTON

CULLEN COLLEGE of ENGINEERING

Department of Civil & Environmental Engineering

# CIVE Seminar


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## Multiphysics Simulation of Nuclear Reactor Fuel Performance and Component Aging

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1:00 PM – 2:00 PM

CBB 122


**Abstract:** Commercial nuclear power reactors provide numerous opportunities for the use of modeling and simulation to improve the understanding of the physical phenomena involved. This improved understanding can be used to develop designs with improved safety and provide improved confidence in assessments of the safety of existing reactors under long-term operation. The open-source MOOSE simulation environment is being developed at Idaho National Laboratory to provide the basis for multiphysics simulation codes tailored to address specific issues in nuclear reactor simulation. This talk provides an overview of MOOSE, as well as detailed discussions of two of the application codes developed based on this framework: BISON and Grizzly. BISON is a code for modeling the thermo-mechanical behavior of nuclear fuel. Specifically, the use of BISON to model pellet-cladding interaction and fracture in ceramic nuclear fuel will be highlighted. Grizzly is a code for modeling age-related degradation of nuclear power plant components, and for modeling the ability of those components to safely perform in such conditions. This talk will also discuss the development of capabilities in Grizzly to model the degradation of reactor pressure vessels and concrete structures under exposure to normal operating environments.


About the speaker:

**Benjamin Spencer** is a computational scientist in the Fuel Modeling and Simulation Department at Idaho National Laboratory (INL). He leads the development team responsible for solid mechanics models used in INL's MOOSE-based simulation codes, and is the technical lead for development of the Grizzly code. He has done extensive work developing general solid mechanics, XFEM, fracture mechanics, contact enforcement, and solver capabilities, and applying these to nuclear energy-related problems. Prior to INL, he worked nearly 10 years at Sandia National Laboratories, where he developed similar code capabilities and applied modeling and simulation to nuclear safety problems. He received his B.S. in Civil Engineering from Brigham Young University, and his M.S. and Ph.D. in Civil Engineering from the University of Colorado, Boulder.