## Albany: a Trilinos-based multi-physics partial differential equation research tool created using the Agile Components code development strategy

I. Tezaur, A. Salinger, G. Hansen, D. Ibanez

The focus of this talk is the Albany multi-physics finite element code, and Sandia's Agile Components code development strategy, of which Albany is a chief incarnation. The Agile Components strategy enables the rapid development of parallel, efficient multi-physics tools by requiring that: (1) application codes be built primarily from modular pieces (independently developed libraries, e.g., Trilinos), abstract class hierarchies, and template-based generic classes, and (2) projects both leverage and contribute to a comprehensive set of software components, consisting of libraries, interfaces, software quality tools, and demonstration applications. Codes like Albany created using Agile Components are "born" scalable, fast, robust, performance-portable, and equipped with a quality software infrastructure.

This talk will describe the overall design of Albany in the context of the Agile Components approach, and highlight the specifics of several of its key features, including: (1) template-based generic programming, (2) automatic differentiation utilities for calculating Jacobians and enabling beyond-forward analyses requiring sensitivities/adjoints, (3) the Model Evaluator interface for specifying complex nonlinear PDEs, (4) flexible interfaces to 2 adaptive mesh libraries, and (5) performance portability using Kokkos. I will present results showcasing these key capabilities for some Albany multiphysics problems from the domains of climate and solid mechanics.