Overview of Center for micromorphic multiphysics porous and particulate materials simulations within exascale computing workflows

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Friday | November 10, 2023 | 11am | Malone 137

The talk will present an overview of a Department of Energy (DOE) Predictive Science Academic Alliance Program (PSAAP) Center entering its 4th year (out of 5). The overall objective of the Center is to simulate with quantified uncertainty, from grain-to-continuum-length-scales, a class of problems involving large deformations, fracture, and fragmentation of unbonded and plastically-bonded particulate materials. The overarching problem is to predict with quantified uncertainty the processing and mechanical behavior of pressed mock High Explosive (HE) material subjected to quasi-static and high-strain-rate confined and unconfined compression with in-situ X-ray computed tomography (CT) and Digital Image Correlation (DIC). To accomplish the objective, a micromorphic multiscale computational framework is being developed, verified, and validated with quantified uncertainty, and executed on Exascale computing platforms. A summary of the latest results across the Center will be presented, along with more specifics on a micromorphic grain-to-continuum numerical upscaling procedure.

Bio: Professor Richard Regueiro received his PhD in Civil and Environmental Engineering at Stanford University in 1998. He then became a member of the technical staff at Sandia National Laboratories, California, from 1998 to 2005, at which time he began his academic career in the Department of Civil, Environmental, and Architectural Engineering at the University of Colorado Boulder. His research focuses on computational multiscale multiphysics materials modeling for simulating inelastic deformation and failure in heterogeneous porous media, including saturated and partially saturated soils and rock, unbonded particulate materials (e.g. sand, gravel, metallic powders), bonded particulate materials (e.g., sandstone, asphalt, concrete, explosive materials), soft biological tissues (e.g., ocular lens tissue, lung parenchyma, vertebral disk), and thin deformable porous materials and membranes, for instance. Scales of interest range from the microstructural and ultrastructural to the continuum. He is currently Principal Investigator (PI) for an NNSA Advanced Simulation and Computing (ASC) Predictive Science Academic Alliance Program (PSAAP) project, "Center for Micromorphic Multiphysics Porous and Particulate Materials Simulations within Exascale Computing Workflows."

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