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MESOSCALE MODELING OF HETEROGENEOUS GEOLOGIC MATERIALS: METHODS AND APPLICATIONS

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ABSTRACT

Geologic materials have a complex constitutive response that is affected by the heterogeneous composition of the material, as well as the presence of voids, defects, fractures or joints on a larger scale. Mesoscale simulation methods attempt to predict how the micromorphology of a material affects the continuum constitutive response, and to reveal important mechanisms that may inform continuum model development. Ever increasing computational power and improvements in numerical methods have allowed for greater sophistication in mesoscale simulations, to investigate how microscale effects such as fracture, damage, compaction, contact, frictional slip, fluid transport, thermal effects, phase change, and inelasticity affect the apparent continuum response of a material. Through mesoscale simulations, it is possible to gain a greater understanding of complex phenomena in geomaterials, such as shear-enhanced compaction, damage, latent and induced anisotropy, rate and scale effects, as well as fluid saturation effects. Persistent challenges include development of numerical methods that are robust and accurate for modeling inelastic response of porous and brittle materials (especially under combinations of shear and compressive loading), the disparity in length-scales inherent to modeling damage and comminution in a heterogeneous material, the definition and parameterization of suitable continuum models for the constituent phases in the mesoscale model, and validation of mesoscale model response.

This symposium seeks to bring together researchers who are working to develop numerical methods for mesoscale simulation of porous and brittle materials and those using mesoscale models to investigate complex phenomena in geologic materials. Investigations of damage, compaction, fracture, or comminution in granular materials is welcome, as is application of mesoscale methods to study nonlinear response of non-geologic (e.g. additively manufactured) porous and brittle materials. Experimental or theoretical work to provide constitutive model and other parameters for mesoscale simulations is welcome, as well as work to validate the

results of mesoscale simulations. Multi-scale simulation approaches and methods for transitioning mesoscale results into continuum models are encouraged.