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Grain to continuum considering mesoscale: computational framework for projectile penetration through granular material[1] ANNE TURNER, DAYAKAR PENUMADU, University of Tennessee, Knoxville, ERIC HERBOLD, Lawrence Livermore National Lab — High-speed projectile penetration through granular materials is governed by the particle or grain level (mesoscale) physics including inter-granular contact forces, particle reorientation, deformation and fragmentation. In this work, we investigate a method for numerically capturing the initial meso-structure of the assembly and morphology of individual particles using high resolution computed X-ray and neutron tomography. Using the finite element code, GEODYN-L, Ottawa sand specimen assembly directly measured from high resolution computed radiation based tomography non-invasively are numerically simulated to represent the initial state of compaction and subsequently subjected to one-dimensional compression. The effects of selected finite element formulations and grain discretization approaches are investigated to maximize the ability to capture high stress concentrations at contact points between grains, where fracture is likely to initiate, yet maintaining computational efficiency. The effect of coordination number on the contact forces and resulting stress distribution within a grain is also examined. This "grain to continuum considering meso-scale" computational framework is being developed to for realistic representation of deformation and damage mechanics associated with projectile penetration through granular materials.

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