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2D Mesoscale Simulations of Projectile Penetration into Sand
R.D. TEETER, S.K. DWIVEDI, C.W. FELICE, Y.M. GUPTA, Institute for Shock Physics, Washington State University — Physical Phenomena governing projectile instabilities during penetration of granular media (e.g. sand) are not well understood. To gain insight into projectile – granular media interactions, 2-D mesoscale simulations were performed to examine projectile penetration into sand targets with explicit representation of sand grains and representative porosities. The computational procedure used to generate a mesoscale representation of a sand target is presented with emphasis on an energy minimization technique for grain placement and modified Voronoi tessellations to enforce desired grain size and geometry. Simulated sand targets are shown to reproduce grain size distributions and porosities as large as 30% in close agreement with input parameters. Further, initial results from 2D mesoscale simulations, using the ISP-TROTP code, of normal impact of ogive shaped impactors at 0.5 km/s, 1.0 km/s, and 1.5 km/s impact velocities show that heterogeneous deformation in a frictionless granular media can cause deviation of projectile motion from normal direction indicating projectile instability during penetration. Efforts to achieve an improved description of granular media are underway. Work supported by DOE and AFOSR.

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