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Micromechanical approach to model deformation response of granular materials using FEM considering meso-structure from X-ray computed tomography[1] MOHMAD MOHSIN THAKUR, DAYAKAR PENUMADU, University of Tennessee, Knoxville — The discrete nature of granular materials results in complex mechanical interactions such as non-affine deformations including slippage at grain contacts, force chain buckling and shear banding. Even until now, geomechanics community largely relies on triaxial testing as the basis for constitutive behavior at continuum scale. However, the continued evidence with the lack of suitable predictive models with reasonable number of parameters to capture phenomenological effects makes us believe that this problem is too complicated for any continuum-based approach. The urgent need is to incorporate mesoscale effects which are discrete and non-repeating in the numerical modeling, and hence FEM and X-ray CT imaging are explored concurrently. The 3D X-ray CT images of Ottawa sand are transformed into a 3-D FEM mesh to solve a boundary value problem using actual grain and pore microstructure. The variation in contact interaction properties such as limiting shear stress and elastic slip stiffness between the surface of grains is investigated. Additionally, development of force chains and shear bands on cylindrical specimen is presented with jamming/unjamming of force chains evident in kinetic energy and deviatoric stress oscillations

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