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A constitutive model for dry soils under a wide range of pressures
ERIC HERBOLD, MICHAEL HOMEL, Lawrence Livermore Natl Lab, M.B. RUBIN, Israel Institute of Technology — A constitutive model is developed for dry soils that smoothly transitions across a wide range of pressures and temperatures. This model handles large-deformations and is thermomechanically consistent. Ideas from critical state soil mechanics via a breakage model, which model granular media at relatively low pressure, are combined with an equation of state for shock loaded solids to investigate the compaction of initially unconsolidated brittle granular materials. The resulting constitutive equations provide a fully-coupled model containing a natural transition between granular and solid states through the Helmholtz free energy. The model is calibrated to data with a wide-range of pressures and strain rates for Ottawa sand and predictions of the model are compared with static compaction, penetration and shock-loading results. Based upon this calibration, the compaction model predicts Hugoniot temperatures converge with "snow-plow" model at approximately 8 GPa. This work was performed under the auspices of the U.S. Department of Energy (DOE) by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

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