Abstract Submitted
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Stress, Structure, and Force Measurements in Jammed 3D Granular Solids[1] RYAN HURLEY, Lawrence Livermore Natl Lab, STEPHEN HALL, Lund University, JONATHAN WRIGHT, European Synchrotron Radiation Facility, ERIC HERBOLD, Lawrence Livermore Natl Lab — When subjected to external load, a jammed granular material develops an internal network of contact forces at the micro-scale. This force network controls the stress, stability, and transport properties of the material at the macro-scale. In order to understand this transition between scales and evaluate the accuracy of continuum descriptions of granular solids, measurement of variables at both length scales is needed. In this work, we discuss experiments that furnish such measurements. In particular, we combine X-ray diagnostics with numerical analysis to furnish intra-grain strains, continuum strains, contact network fabric, and force networks in a deforming 3D granular solid composed of microscopic ruby grains. We evaluate the statistical and structural nature of the contact and force network and study homogenization length scales that determine when various variables become correlated. By observing changes to contact and force networks during local rearrangements and grain fracture events, we also examine the grain-scale origins of non-locality. We discuss the current capabilities of such experimental approaches and how they will aid in developing continuum descriptions of granular solids in the future.

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Ryan Hurley
Lawrence Livermore Natl Lab

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