Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Rheology of Dense Granular Flows near the Flow-Arrest Transition ISHAN SRIVASTAVA, Lawrence Berkeley National Laboratory, LEONARDO SILBERT, Central New Mexico Community College, GARY GREST, JEREMY LECHMAN, Sandia National Laboratories — Granular materials exhibit a dynamical transition between arrested and steady flowing states at a critical ratio of shear stress and hydrostatic pressure. Although their simple-shear steady-state rheology is now well-characterized, the transition itself is accompanied by interesting dynamical phenomena such as transient dilatancy and shear jamming, which are not well understood. This transition is highly stochastic, which makes its continuum modeling quite challenging. Additional complications are introduced by a dependence on deformation paths, with important differences between the rheology of shear-induced and compression/extension-induced flows. We demonstrate such complex rheological scenarios that emerge at the flow-arrest transition of granular materials using stress-controlled discrete element simulations. We introduce and calibrate a continuum rheological model, derived from a dissipative rheological theory, which is applicable to viscometric and extensional flow regimes, and incorporates important rheological features such as normal stress effects and flow-arrest transitions.

Ishan Srivastava
Lawrence Berkeley National Laboratory

Date submitted: 14 Aug 2020 Electronic form version 1.4