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Rheology of simple shear flows of dense granular assemblies in different regimes SEBASTIAN CHIALVO, JIN SUN, SANKARAN SUNDARESAN, Princeton University — Using the discrete element method, simulations of simple shear flow of dense assemblies of frictional particles have been carried out over a range of shear rates and volume fractions in order to characterize the transition from quasistatic or inertial flow to intermediate flow. In agreement with previous results for frictionless spheres [1], the pressure and shear stress in the intermediate regime are found to approach asymptotic power law relations with shear rate; curiously, these asymptotes appear to be common to all intermediate flows regardless of the value of the particle friction coefficient. The scaling relations for stress for the inertial and quasistatic regimes are consistent with a recent extension of kinetic theory to dense inertial flows [2] and a simple model for quasistatic flows [3], respectively. For the case of steady, simple shear flow, the different regimes can be bridged readily: a harmonic weighting function blends the inertial regime to the intermediate asymptote, while a simple additive rule combines the quasistatic and intermediate regimes.

[1] T. Hatano, et al., J. Phys. Soc. Japan 76, 023001 (2007).
[2] J. Jenkins, and D. Berzi, Granular Matter 12, 151 (2010).
[3] J. Sun, and S. Sundaresan, J. Fluid Mech. (under review).

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