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Bridging the Rheology of Dense Granular Flows in Three Regimes SEBASTIAN CHIALVO, JIN SUN[1], SANKARAN SUNDARESAN, Princeton University — Using the discrete element method, simulations of simple shear flow of dense assemblies of soft, frictional particles have been carried out over a range of shear rates and volume fractions in order to characterize the rheology of granular flows in three regimes. In agreement with previous results for frictionless spheres [1], the pressure in each regime is found to obey an asymptotic power law relation with shear rate. These relations are then used to construct a blended pressure model. Additionally, we constitute the shear stress ratio in terms of two dimensionless groups: the inertia number [2], which governs the rheology of hard particles, and the ratio of shear time to the particle binary collision time, which characterizes the departure from hard-sphere behavior. The pressure and shear stress ratio relations form a rheological model that, in the hard-sphere limit, can be written as a modified kinetic theory for dense granular flows [3].

[1] T. Hatano, et al., J. Phys. Soc. Japan 76, 023001 (2007).
[2] da Cruz, F. et al., Phys. Rev. E 72, 021309 (2005).
[3] J. Jenkins, and D. Berzi, Granular Matter 12, 151 (2010).

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