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Energy Dissipation in Inertial Granular Flow ERIC DEGIULI, New York University, JIM MCELWAINE, Durham University, MATTHIEU WYART, New York University — Experiments and simulations have shown the utility of considering dense inertial flow of frictional granular materials as a function of the inertial number I. However, the dependence of the rheology on the particle-particle friction coefficient μ_p has hardly been studied. In this work we use numerical simulations to systematically study the dense-flow rheology over a large range of I and μ_p, leading to a phase diagram with 3 phases: frictionless, frictional, and super-frictional. By studying carefully energy dissipation in steady flow, we delineate the boundary of the frictionless regime in the (μ_p, I) plane, and find, surprisingly, two regimes of frictional flow. We show that the flow dynamics of the frictionless regime quantitatively agrees with the theory proposed in DeGiuli et al PRE 91, 062206 (2015). Moreover, in the superfrictional regime at very large μ_p, the rheology is also strikingly similar to frictionless flow. We are able to understand the crossovers between these regimes by a scaling analysis of energy dissipation.

Eric DeGiuli
New York University

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