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Inertia and dissipation mechanism in jammed soft-particle suspensions ARKA ROY, KAMRAN KARIMI, CRAIG MALONEY, Carnegie Mellon University — Suspensions of soft particles exhibit a remarkable bifurcation at the random close packing volume fraction, fc. There is a yield stress above fc but not below, and the flow curves at various f have been shown to collapse onto a universal scaling function near this point. Particle-level models take contact deformation into account to model elastic forces and treat the drag forces in the very dense regime where long-range hydrodynamic interactions are thought to be negligible - with varying levels of sophistication: from "pair-drag" formulations that apply a lubrication calculation to the film at contact to simple "mean drag" approaches where the mobility matrix is diagonal. We show that, in simple shear, these two model give consistent results for the shear modulus, yield stress, and single-particle diffusivity as functions of f but only in the quasi-static regime. They show dramatically different behavior in the rate-dependent regime. In particular, the diffusion constant scales as the shearing rate to a non-trivial power with the power depending on the damping mechanism. Furthermore, we explore a "granular" regime where the inertia of the particles is no longer negligible and the finite rate behavior shows a complex interplay between inertial and dissipative timescales.

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