

Viscous to Inertial transition in dense granular suspensions

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Dense granular suspensions exhibit different regimes based on boundary conditions and stress distribution. The flow is mainly controlled by the shear rate to particle pressure ratio, which can be described by a frictional approach for dilatant granular media. However, as the shear rate increases and the fluid viscosity decreases, the flow can transition from a viscous to an inertial regime. Dimensional analysis alone cannot provide the crucial information to determine this transition, and experimental evidence is limited to numerical works.

This study presents experimental evidence of the viscous-inertial transition for suspensions of non-colloidal rigid particles. A pressure-and-volume imposed rheometer is used to explore the dense regime systematically by varying interstitial fluid, shear rate, and packing fraction. The transition occurs at a specific Stokes number independent of the packing fraction. The algebraic power law for the viscosity divergence is also shown to be independent of the regime. These results provide important insights into the behavior of dense granular suspensions and have implications for a variety of fields

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