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Measurements of the Yield Stress in Repulsive Athermal Systems
NING XU, COREY O'HERN, Yale University — We performed molecular dynamics of dry frictionless granular media to gain a deeper understanding of the yield shear stress in these materials. The measurements were obtained by shearing the systems in both the constant shear force and constant shear velocity ensembles. At fixed shear force, we identified the yield shear stress as the shear stress Σ_{yf} required to maintain steady flow in an initially unsheared static state. At fixed shear velocity, we identified the yield shear stress as the average shear stress Σ_{yv} in the limit of zero shear velocity. At finite system size, $\Sigma_{yf} > \Sigma_{yv}$, which implies that there is a shear rate discontinuity when the system begins flowing in the constant shear force ensemble. However, the difference between the two measures of the yield shear stress decreases with increasing system size; Σ_{yf} and Σ_{yv} become identical in the infinite system size limit. Thus, the jump discontinuity in the shear rate at the unjamming threshold is a finite-size effect in frictionless granular systems.

Ning Xu
Yale University

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