

Abstract Submitted
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Failure of a loose packing of grains GREG FARRELL, NARAYANAN MENON, UMass-Amherst — One-sided repulsive interactions and history-dependent friction forces can cause the mechanics of real granular systems to deviate significantly from that of cohesive solids. Marked deviations from elastic behavior can be seen in the mechanical response and structure of sedimented loose packings of frictional spheres even for very delicate perturbations. In our experiments, particles' displacements are observed with 3D fluorescent imaging as a shear plane is displaced through the packing. As anticipated, we find the shear force is approximately linear with the displacement between discrete yielding events. However, even in this apparently linear region, structural aging continues to occur for the smallest displacements that we can apply. This suggests the inaccessibility of a reversible shear deformation regime in loose packings of granular material. We present a spatial characterization of the particle motion that distinguishes between these continuous instances of irreversibility and the larger discrete failure events.

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