Department of Mathematics and Statistics Colloquium

Jamming, Shaking, and Mixing in a Granular "Fluid"

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Abstract: Granular materials exist all around us, from avalanches in nature to the mixing of pharmaceuticals, yet the behavior of these fluids is poorly understood. While the interaction of individual particles is simply through friction and inelastic collisions, the non-linear forces and large number of particles leads to an unpredictable, complex system. Flow can be characterized by the continuous forming and breaking of a strong force network resisting flow, leading to jamming, avalanching, and shear banding. I'll present recent work on quasi-static shear and free-surface granular flows under the influence of external vibrations as well as related experiments on particle-fluid suspensions. By using photoelastic grains, we are able to measure both particle trajectories and the local force network in 2D flows. We find through particle tracking that, unlike solids and liquids, (i) mean flow, elastic deformation, and diffusive/plastic rearrangements all happen simultaneously on similar scales, (ii) shaking can cause either failure or strengthening of granular piles, and (iii) interstitial fluids can greatly impact the flow. Each of these points to the difficulties in developing predictive models for relevant applications.

Monday, September 12 at 3:45 in Roop 103

refreshments at 3:30