ACOUSTICS2008/1656
Force fluctuations in granular disks near the jamming threshold

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We study experimentally the force fluctuations felt by a probe disk as it is dragged at a nominally constant rate through a two-dimensional bi-disperse system of randomly packed photo-elastic disks. As the packing fraction increases from loose packing to a value where the disks are jammed, lines of connected force - stress chains - develop that couple the entire domain. We consider the transition from an unjammed state with no long range force distribution to a jammed state with stress chains spanning the system size. We characterize this transition using the measured force fluctuations and the determination of stress chains as visualized by the photo-elastic disks. Length and time scales obtained from these measurements are used to describe both the transition to jamming and the nature of the jammed state. The reorganization of disks and the force fluctuations have a stick-slip character in the jammed state.