Tata Institute of Fundamental Research
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Seminar

Shear induced geometry and jamming in sphere packings

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Rigidity or jamming in amorphous sphere assemblies can be induced by compression or by shear deformation. In frictionless sphere packings, jamming occurs at the packing fraction of 64%, also known as random close packing density (RCP). In the presence of friction, jamming can occur below RCP when subjected to compression or shear deformation. In our work, we show shear deformation leads to geometrical features that are characteristic of jammed packings at RCP for a wide range of densities below RCP in frictionless packings. We test the mechanical stability of shear deformed frictionless packings, with and without the inclusion of frictional forces, to understand the distinct roles played by shear deformation & friction in shear jamming phenomenology. We develop a new method to obtain contact forces for a given contact network by solving for force balance conditions. Using this method we obtain an ensemble of force configurations for sheared frictionless packings with the inclusion of frictional forces. In the density - shear strain plane, we identify the shear jamming line separating the unjammed and the jammed states, in two & three dimensions. In two dimensions, from the rigidity percolation analysis, we show that sheared frictionless configurations are rigid in the presence of normal and tangential constraints. In our study, we find the presence of an intermediate phase for a range of strain values, for different densities, analogous to the rigidity transition observed in chalcogenide glasses.

Tuesday, May 1st 2018

11:30 AM (Tea/Coffee at 11:00 AM)

Auditorium, TIFR-H