LadHyX Seminar – February 1st, 10:45

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**Granular matter: from bouncing grains to cohesive interactions**

In this talk, we explore two different states of the granular matter: the dilute and the dense regimes, navigating between the grain scale and the material scale.

The dilute example involves bouncing grains: when sand is sprinkled on a vibrated membrane, grains move until they eventually settle in the nodes of vibration, forming the so-called "Chladni patterns" and providing an easy visualization the membrane's modes. However, there is no consensus on the mechanism by which bouncing grains migrate on the vibrated membrane. To quantitatively explain this phenomenon, we propose a statistical description of grain motion. The particles behave as random walkers, whose diffusivity increases with the vibration amplitude. This simple model successfully explains the dynamic of a Chladni pattern.

The second part of the presentation focuses on how cohesive forces between grains modify the flow of dense granular materials. Specifically, cohesive flows exhibit fractures and aggregation, that classical mu(I)-rheology fails to capture. To address these effects in a continuous model, we conduct experiments using a cohesion-controlled granular material encompassing a wide range of cohesion. For instance, the granular-collapse configuration highlights the effect of cohesion on the flow velocity. However, to separate the influence of cohesion on flow dynamics from the formation of fractures, we then designed a flexural experiment to explore specifically fracture formation under quasi static conditions. Subsequently, we compare the experimental results with both discrete and continuous numerical simulations.