How disorder affects the onset of sliding of a frictional system

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The objective of this project is to understand how heterogeneities present between two contacting solids affect the onset of sliding of the frictional system. The project uses concept derived from fracture mechanics, solid friction, granular media mechanics. The work is experimental, mainly based on image analysis and elastic deformations measurements (displacements, strains, stresses).

Context

We know for long that the onset of sliding is preceded by the propagation of a rupture front along the interface, which breaks the solid contacts formed between the solid surfaces. Along a seismic fault for example, this rupture is responsible for the ground shaking during an earthquake.

It has been recently shown that within homogeneous systems, this rupture is a shear crack and that the framework of fracture mechanics can be used to describe the onset of motion of a frictional system. However such a rupture has not been observed for disordered interfaces, when powder or grains are trapped between the sheared solids.

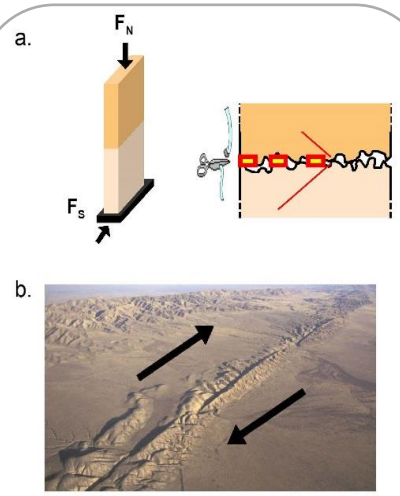

Fig. 1: (a) Two solid bodies are pressed and sheared. The onset of motion is preceded by the propagation of a shear crack breaking the sparse solid contacts forming the interface. (b) San Andreas fault (Kevin Schafer).

Objective

We want to observe the rupture front at the onset of sliding along a granular interface and determine if fracture mechanics is still valid for disordered systems. We will measure the deformation of the solids near the interface and try to find a signature of the interface composition. For a PhD, the project will be extended to different type of disordered structures. We will also study the rupture initiation and how to control it using interfacial heterogeneities.