Data-Driven Mechanics Laboratory

Master thesis

Multiphysics modeling of fault gouge

Description: The fault gouge, a layer of cohesionless material formed by fragmentation of parent rock, plays a key role in the macroscopic frictional behavior of faults, including their stability and energy release [1]. This material exhibits complex behavior influenced by mechanical deformation, thermal effects and pore fluid flow. In this project, we utilize a combination of discrete and continuum simulations to investigate gouge rheology. In particular, the student will explore the effect of material heterogeneity and grain-scale characteristics on the macroscopic behavior, including the influence of particle fracture. Additionally, phenomena arising from hydromechanical and thermomechanical coupling will be studied. The findings from the project aim to provide new insight into earthquake mechanics.

Prerequisites:

- Background in computational mechanics
- Strong coding skills (C++)

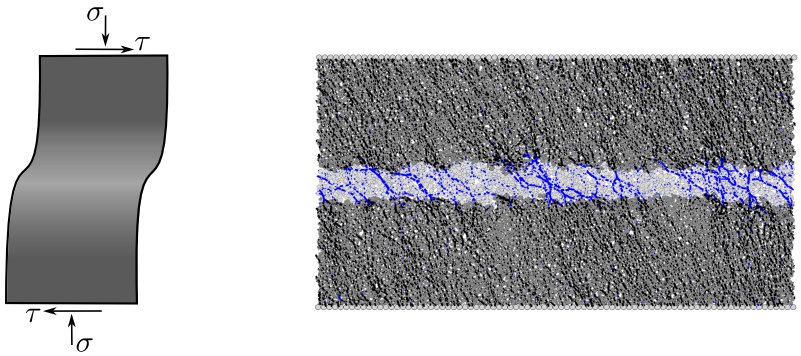

Figure 1: Continuum (left) and discrete (right) mechanical simulation of a granular fault gouge.

References

[1] Omid Dorostkar, Robert A Guyer, Paul A Johnson, Chris Marone, and Jan Carmeliet. On the micromechanics of slip events in sheared, fluid-saturated fault gouge. *Geophysical Research Letters*, 44(12):6101–6108, 2017.

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