A MULTIBODY MESHFREE APPROACH FOR THE SIMULATION OF GOUGE MELTING IN SEISMIC FAULTS

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Melting of fault gouge during fast co-seismic slip has been widely documented in laboratory studies. Because the real-time observation and local probing of this phenomenon is experimentally out of reach at the present time, the implication of melting on fault weakening are not yet fully understood,. Physics-based numerical modelling of a synthetic sliding interface could thus be a way to bring a better understanding of this physico-mechanical process.

In this study, we present a numerical work paving the way towards such an understanding. It is implemented in MELODY [1], a numerical tool combining Discrete Element Method (DEM) and a Multibody Meshfree Approach (i.e. highly deformable DEM). In this model, a small patch of seismic fault filled with granular gouge (composed of perfectly rigid and incompressible grains with realistic angular shapes) is simulated. By shearing this simulated fault, we produce highly deformable gouge particles within a melted layer.

Numerical results show that melting processes have strong consequences on the fault rheology, by reducing shear stress and favouring the localization of the deformation on the sliding interface [2]. Results are compared with experimental observations on saw-cut faults deformed in triaxial conditions in the laboratory. The derivation of simplified friction laws fitted on the numerical results, and their combination with shear localization and heat creation and diffusion, allows to simulate melt-related friction drops during coseismic slip.

REFERENCES

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