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Seminario

Numerical modelling of brittle rock deformation using the Discrete Element Method

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Abstract:
Brittle deformation processes play an important role in determining the evolution of the geometry and the mechanical behaviour of geological structures at many scales. Numerical modelling provides a way towards a deeper understanding of the mechanisms and parameters controlling these deformation processes. The Discrete Element Method (DEM) is a well established numerical method which enables the simulation of brittle deformation processes. Its key advantage compared to continuum-based approaches such as the Finite Element Method (FEM) is the ability to model material discontinuities in a natural way, even if those discontinuities are densely distributed in the model volume and emerge dynamically during the deformation process. The open-source software package ESyS-Particle has been developed with the aim to enable the study of complex geological deformation processes using large, high-resolution DEM models exploiting the computational power of parallel computer systems.
Using this software, the mechanics of faults and fractures has been studied at a range of scales from the formation of km-scale fault systems, the evolution of roughness on m-scale fault surfaces to granular processes in sub-mm scale fault gouge models. The common observation between all those different model is that the way the systems behave is controlled by complex feedback mechanisms between mechanics and an evolving geometry. This observation is perhaps most strikingly demonstrated in the simulated fault gouge where the macroscopic friction of the fault is controlled much more strongly by the shape of the gouge grains than by the micro-scale intra-grain friction.

Proponente: Matteo Massironi