Simulations in large tridimensional Discrete Fracture Networks (DFN): I. Geometric modeling and mesh generation

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Fractures in the Earth's subsurface have a strong impact in many physical and chemical phenomena, as their properties (in particular their permeabilities) are very different from those of the surrounding rocks. They play a major role in diverse fields of applications such as groundwater extraction, oil and gas exploitation, geothermal energy production, CO2 sequestration, etc. In this presentation, we focus on the well-known Discrete Fracture Network (DFN) models and on efficient techniques to mesh them. The generated meshes are subsequently used to carry out numerical simulations*.

In the DFN models [1, 2, 3, 4], fractures are represented by ellipses that are randomly generated in the tridimensional space, following experimental statistics. To make this model suitable for classical surface and volume meshers [5, 6], it is necessary to add some information, which is accomplished in several steps: computation of the intersections between fractures, selection of fractures using a graph structure, and construction of a conforming set of edges that can be used as input for a mesh generator. All these steps present special difficulties if there are large numbers of fractures with distances, lengths and angles spanning over several orders of magnitude. Computational times are also critical, and only linear time algorithms can be accepted. In this talk, a methodology for modeling and meshing DFNs will be presented, and recent meshes up to hundreds of thousands of fractures will be shown.

*See Pichot *et al. MASCOT 2018 abstract, Simulations in large tridimensional Discrete Fracture Networks (DFN): II. Flow simulations.*

References

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