Realistic geometric modeling of fracture networks

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ABSTRACT

In geological media, natural fracture networks are commonly encountered, showing a great variety in size and organization. As examples, diverse fracture structures can be observed with a size scale of 5 centimeters in coal cleat networks, 1 meter in granite or 100 meters in sand stones. These fractures play a key role in many physical (mechanical, thermal and hydraulic) and chemical phenomena, as their characteristics (notably their high permeability) are totally different from those of the surrounding rock matrix. A realistic simulation of networks with thousands of fractures remains a challenging objective in many fields covering, for example, energy and environment (oil reservoirs, geothermal energy production, nuclear waste storage, CO2 storage, groundwater resources, …).

This talk will focus on the geometric modeling and automatic meshing of such fracture networks. Fractures are modeled by ellipses that intersect in the tridimensional space. Their geometric properties (centers, sizes, orientations) result from experimental statistics. A mesh is generated, taking into account local complex configurations and highly varying sizes of the fracture intersections. The quality of the mesh elements must be suitable for numerical simulations. To this end, original methods of geometric modeling and mesh optimization have been developed. Mesh examples and corresponding numerical results demonstrate the robustness and efficiency of this approach.

REFERENCES

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