

Computation of flow properties of large scale fractured media

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Fractures play a key role in many physical phenomena and have characteristics specific different from the surrounding rock matrix. Thus, computing the hydraulic properties of large scale fractured media raises many challenges, both in terms of mesh generation accurately representing the fracture geometry and in terms of numerical method to accurately solve the flow equations. The main novelty of this presentation is to combine different strategies to compute the flow properties at a moderate cost. Typically we combine advanced methods to generate high quality meshes together with robust methods based on mortar techniques to solve the flow.

First, we will present the two steps software BLSURF_FRAC [1]. In a first phase, it builds a geometric model including fracture intersections. The main difficulty is to build valid curve discretizations. To do so, BLSURF_FRAC implements automatic corrections. In a second phase, it generates a mesh of the geometric model by calling a user-selected planar mesher. As planar meshers, we propose to consider the two followings, BAMG and BL2D. We will use the ability of BL2D to adaptively refine the mesh, for more accurate and less expensive flow computations.

Then we will present Geofracflow, a software for the simulation of flow in large scale DFNs. Geofracflow is interfaced with BLSURF_FRAC. It implements the Mixed-Hybrid Finite Element method in an optimized way, using vectorization, to decrease the computational time. It handles either matching or non-matching meshes at the intersection between fractures, sink/source terms and contrasts in transmissivities from one fracture to another.

Finally, as a set of benchmark test cases, we extend those proposed in [2, 3] to DFNs generated with the UFM framework [4, 5]. They are large scale DFNs where the fracture size distribution matches the observations and where fractures are organized so that large fractures inhibit the smaller ones, creating T-termination configurations. Hydraulic properties will be computed on these networks.

References

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