Parallel simulator of saturated porous media with fractures

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Motivated by numerous applications in the hydrogeology, we develop a simulator of the underground water flow in a disrupted rock massif. The small cracks are represented by a virtual water conductivity of the rock, while the large cracks and their intersections are modeled by an overlapping mesh of surfaces and lines respectively. For the discretization of the 3D-2D-1D problem of the water flow we use a hybridization of a mixed finite elements in order to obtain a divergence free approximation of the velocity field. The simulator allows nonconforming discretization of the individual dimensions, but we lack a theoretical justification for this approach. The parallelization of the simulator is done via the domain decomposition using essentially the PETSC library.

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