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MULTISCALE MODELING OF HYDROMECHANICAL BEHAVIOR AND FRACTURING OF SHALE GAS

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In the context of the exploitation of shale, gas reservoir rock is subjected to coupled hydromechanical stresses. To investigate the integrity of the well and the reservoir, and to improve operating techniques, it is necessary to carry out coupled numerical simulations taking into account failure.

For law damage state, it is possible to assume that the cracks are isotropic and uniformly distributed. Then it remains to determine a link between the value of the damage D and the permeability K. This link can be established experimentally [1] or analytical [2]. However, if the structure is heavily damaged, with one or more macro-cracks, the above hypothesis are no longer true. Here we choose to use a discrete cracking representation (through the E-FEM method) in order to carry out the computations for transfer.

The model we present here is a model using a multi-scale analysis block type. Using a kinematic enrichment of weak and strong discontinuities can be inserted within the same elements. These discontinuities can represent a heterogeneous medium (using low discontinuities) and a crack (strong discontinuities) [3]. The transfer coupling cracking can then be established on the basis of crack openings, and a Poiseuille flow.

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