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Numerical Flow Analysis Through Hydraulically Fractured Reservoirs

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Abstract

The gas flow in shale reservoirs involves complex processes with many mechanisms such as Knudsen diffusion, slip flow (Klinkenberg effect), gas adsorption and desorption, strong rock-fluid interaction. Shale formations are characterized by extremely low-permeability. The major infra structural continuing changes in a shale reservoir due to hydraulic fracturing is mainly the subdivision of fracture-matrix networks in each layer.
As the direction of fluid flow is dependent on the direction of pressure gradient, and the Anisotropy of hydraulic properties of subsurface rock formations plays a significant role in dictating the direction of fluid flow.
Fracture flow characteristic for flow in cracks and faults due hydraulic fracturing, pressure conditions on the crack inlet and onlet and finally the effect on production has been investigated by Matlab Reservoir Simulation toolbox (MRST).
For implementation of computational algorithms on the grid, the simulator applies vectorised index operation in combination with the mappings between cells and faces. This shows the necessity of applying the harmonic average to obtain face-transmissibilities, and for this we have used the MRST-function computeTrans, which computes the half transmissibilities associated with the two-point flux-approximation (TPFA) discretization. TPFA uses two points and the defined transmissibility in this formulation associated with the connection between the two cells.
The flow equations for the fractured network are then discretized with two-point flux expressions, and a two-phase transport problem is solved. The module provides control volume discretization (two-point flux approximations) of fractured media by representing fractures as sub-domain objects that still are represented as cells in the computational grid, which is used extensively throughout industry.