Incorporating tangential traction into models of hydraulic fracture: effect on fracture growth, redirection, plasticity, fluid rheology and computational performance.

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As was shown in [1], accounting for the shear traction induced by the fluid on the crack surfaces in HF may substantially affect the computational results in terms of their qualitative and quantitative behavior, particularly in the viscosity dominated regime. Surprisingly, it also stabilizes the numerical computations and yields an automatic transition between the limiting regimes of crack propagation. Naturally, the new HF formulation produces results that differ from those obtained for the classical models. This sparked discussion on the validity and applicability of the new approach [2] which was finally substantiated in [3]. Moreover, in [4,5] it has been shown that when the fracture propagates under mixed mode loading the hydraulically induced shear traction significantly affects its redirection angle and plastic zone near the crack tip can be affected.

Recently, the consequences of employing a realistic rheological model (the Carreau model) to describe the non-Newtonian fluids in HF has been analysed. We will discuss its implictations for the modeling of the HF problem under the presence of the hydraulic tangential traction [6].

References

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