Hydraulic Fracture Simulation - Coupling Strategies and Pressure Pulsing

Robert Gracie* **and Matin Parchei Esfahani***

* Department of Civil and Environmental Engineering
Univeristy of Waterloo
Waterloo, Ontario, Canada
e-mail: rgracie@uwaterloo.ca, web page: http://www.civil.uwaterloo.ca/rgracie/

ABSTRACT

Hydraulic fracturing (HF) is simulated in a two dimensional context using the eXtended Finite Element Method (XFEM). This presentation will present recent devolpements in coupling strategies for solving the governing hydro-mechanical systems of equations. Specifically, the recently develop sequential fixed-strain HF split and the sequential undrained HF splits will be discussed [2]. These splitting schemes are analogous to the fixed-strain and undrained splits using in porous media analysis. It will be shown that these new HF splitting schemes are stable and converge with few iterations, in constrast to the simpler more intuitive iterative coupling schemes presented in the literature, which will be show to be unstable. Lastly, recent dynamic analysis of hydraulic fracturing and wave propagation from a well due to high rate pressure pulsing will be discussed, in which interesting phenomena are observed [2], as illustrated in Figure 1.

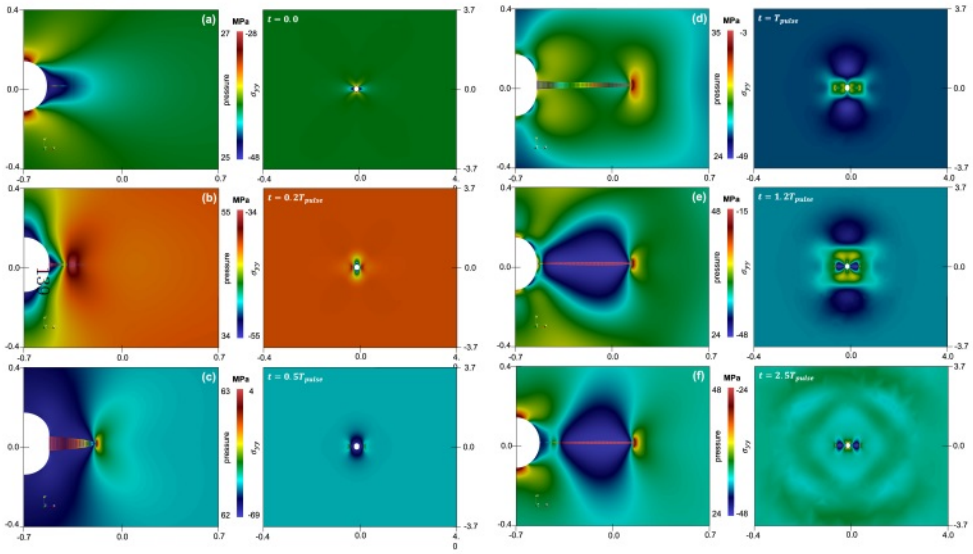

Figure 1: Illustration of hydraulic fracture behaviour due to high rate pressure pulsing [2].

REFERENCES

[1] Parchei Esfahani, M. Advances in Hydraulic Fracture Simulations - Dynamic and Quasi-static Analysis. Thesis submitted to the University of Waterloo, 2019.