AN ENRICHED-FINITE ELEMENT TECHNIQUE FOR NUMERICAL SIMULATION OF HYDRO-FRACTURE EVOLUTION IN NATURELLY-LAYERED FORMATIONS

M. Vahab¹*, Sh. Akhondzadeh ², A. R. Khoei³, and N. Khalili⁴

¹ School of Civil and Environmental Engineering, the University of New South Wales, Sydney 2052, Australia, m.vahab@unsw.edu.au
² Center of Excellence in Structural and Earthquake Engineering, Department of Civil Engineering, Sharif University of Technology, P.O. Box. 11365-9313, Tehran, Iran, akhondzadeh@gmail.com
³ Sharif University of Technology, Center of Excellence in Structural and Earthquake Engineering, Department of Civil Engineering, Sharif University of Technology, P.O. Box. 11365-9313, Tehran, Iran, arkhoei@sharif.edu
⁴ UNSW, School of Civil and Environmental Engineering, the University of New South Wales, Sydney 2052, Australia, n.khalili@unsw.edu.au

Key words: Hydraulic Fracture Growth; X-FEM; Layered Domain; Singular Enrichment Strategy.

In this paper, a computational model is developed for the simulation of hydro-fracture growth in naturally layered impervious media using the extended finite element method (X-FEM) (Vahab et al. [1]). The equilibrium equation of the bulk is solved in conjunction with the hydro-fracture inflow and continuity equations using the staggered Newton method. The hydro-fracture inflow is modeled by using the lubrication theory, where the permeability of the fracture is incorporated by taking advantage of the cubic law (see Khoei et al. [2]). The Eigen-function expansion method is utilized in order to develop enrichment functions suited for the asymptotic stress field in the vicinity of the singular points. An energy release rate-based criterion based on Hutchinson and Sue [3] is used in order to study the competition between hydro-fracture penetration/deflection at the material interface. Finally, the robustness of the computational framework is explored by means of numerical simulation.

REFERENCES