6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

AN ENRICHED-FINITE ELEMENT TECHNIQUE FAOR NUMERICAL SIMULATION OF HYDRO-FRACTURE EVOLUTION IN NATURALLY-LAYERED FORMATIONS

M. Vahab[1]*, Sh. Akhondzadeh [2], A. R. Khoei[3], and N. Khalili[4]

[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

[1] M. Vahab, SH. Akhondzadeh, A.R. Khoei and N. Khalili. An X-FEM investigation of hydro-fracture evolution in naturally-layered domains. *Engng. Fract. Mech.*, Vol. **191**, pp. 187-204, 2018.
[2] A.R. Khoei, M. Vahab and M. Hirmand. An enriched–FEM technique for numerical simulation of interacting discontinuities in naturally fractured porous media. *Comput.Methods in Appl.Mech.Eng.*, Vol. **331**, pp. 197-231, 2018.
[3] J.W. Hutchinson and Z. Suo. Mixed mode cracking in layered materials. *Adv. Appl. Mech.*, Vol. **29**, pp. 63-191, 1991.