UNIVERSITÀ DEGLI STUDI DI TRENTO

Dipartimento di Ingegneria Civile, Ambientale e Meccanica

INSTABILITIES

Instabilities and nonlocal multiscale modelling of materials

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AVVISO DI SEMINARIO

Si comunica che **martedì 16 dicembre 2014 a partire dalle ore 11.00**
si terrà presso l'aula **R2** (via Mesiano 77) il seguente seminario

Interaction between crack tip advancement velocity and fluid velocity in fracturing saturated porous media

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In solid mechanics, except for dynamic problems, crack propagation is considered without invoking the time dimension. This is not the case in crack propagation in fluid saturated porous media. The first difference is that here the fracture lips are not stress free since the fluid pressure acts on them. The second difference is that there are three velocities involved: the crack tip advancement velocity on one side and the seepage velocity of the fluid in the domain and the fluid velocity within the crack on the other. All three velocities interact and strongly influence the outcome of the process: as the crack tip advances the newly created space has to be filled with fluid which comes from the porous media volume surrounding the crack and from flow through the crack itself. Hence time clearly matters in this case. Evidence of the interaction can be found in the fact that different fluid permeability (or dynamic viscosity) influences not only the length of the fracture and the pressure distribution but also its direction Schrefler et al. (2006). But the most important aspect of the interaction between the two velocities is the stepwise advancement of the fracture and the pressure oscillations. Experimental evidence for the stepwise advancement has been obtained by Pizzocolo et al. (2012). Pressure fluctuation has been evidenced by Tzschichholz and Herrmann (1995) with a 2D lattice model for constant injection rate and homogeneous and heterogeneous material which only breaks under tension. These aspects will be investigated with two methods of fracture advancement technique: the first one, in conjunction with Standard Galerkin Finite Element Method (SGFEM) requires continuous updating of the mesh because of the continuous variation of the domain as a consequence of the propagation of the cracks (Schrefler et al., 2006). The second one avoids updating of the mesh by means of an Extended Finite Element Method XFEM (Kraaijeveld et al., 2013, Remij et al., 2014). Examples deal with pressure induced fracture and peel test of a fluid saturated specimen.

References

Kraaijeveld F, Huyghe JM, Remmers JJC, de Borst R (2013) 2-D mode one crack propagation in saturated ionized porous media using partition of unity finite elements. J. Appl. Mech. 80:020907-1-12

Pizzocolo F, Hyughe JM, Ito K (2013) Mode I crack propagation in hydrogels is stepwise. Engineering Fracture Mechanics 97:72-79

Remij E.W., J.J.C. Remmers, F. Pizzocolo, D.M.J. Smeulders, J.M. Huyghe. A Partition of unity based model for crack nucleation and propagation in porous media, including orthotropic materials Transp. Porous Media, in press.

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Schrefler BA, Secchi S, Simoni L (2006) On adaptive refinement techniques in multifield problems including cohesive fracture. Comp Methods Appl Mech Engrg 195:444-461
Tzschichholz F, Herrmann HJ (1995) Simulations of pressure fluctuations and acoustic emission in hydraulic fracturing. Physical Review E 5:1961-1970

Tutti gli interessati sono invitati a partecipare.

Il seminario è organizzato dal gruppo di Scienza delle Costruzioni
(D. Bigoni, L. Deseri, N.Pugno, M. Gei, A. Piccolroaz, F. Dal Corso, M.F. Pantano, R. Springhetti)

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