NUMERICAL INVESTIGATION OF HYDRO-MECHANICAL COUPLING IN FRACTURED POROUS MEDIA, CREEP AND CRACKING OF ROCKS

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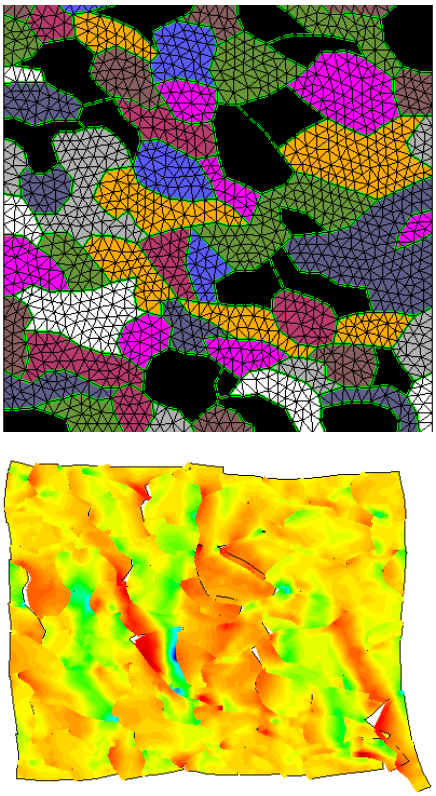

Fig. 1: Inter-granular cracks modelled by CZM in salt polycrystal due to cyclic fatigue and creep

Hydromechanical coupling in cracked or fractured porous media is at the basis of desiccation cracking in soils and concrete, hydraulic fracturing in petroleum applications and fault activation in reservoir formations due to fluid injection. Numerical modelling of these phenomena faces different difficulties both for the hydraulic and mechanical aspects. The mass balance equation for fluid exchange between fractures and the porous matrix was recently extended to multi-fractured porous media and the weak formulation of the flow problem allowed building an efficient Finite Element method for flow in these media. Also cohesive zone models have allowed a great progress for modelling fracture propagation by taking into account non linearities like plasticity and creep. More sophisticated formulations of these models allow modelling propagation under normal, shear or mixed loading modes. Another difficulty, which has impeded the used of FEM for multi-fractured materials, was the difficulty for mesh generation in domains containing a high number of cracks. Recent developments make possible the use of FEM to the case of fractured or cracked media. Based on these progresses, numerical methods have been developed and applied to the analysis of a variety of problems like hydraulic fracturing in reservoir formation, shrinkage cracking in soils and cyclic fatigue and viscous cracking in polycrystalline materials like salt rock. Some examples of these numerical modellings will be given in this presentation.

Guests are welcome!