CSM
CROATIAN SOCIETY OF MECHANICS
ZAGREB – OSIJEK – RIJEKA – SL. BROD – SPLIT

Lecture in CSM:

Treatment of Inelastic Response in Solids Mechanics using Virtual Elements

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ABSTRACT

Virtual elements (VEM) were developed during the last decade and applied to various problems in elasticity. Due to the fact that the element shape of virtual elements can be arbitrary including even non convex shapes these elements are more flexible when the geometry of the element is considered. The success of VEM discretization’s in the linear range using different polynomial orders leads directly to the question whether these elements can also be applied successfully to nonlinear situations.

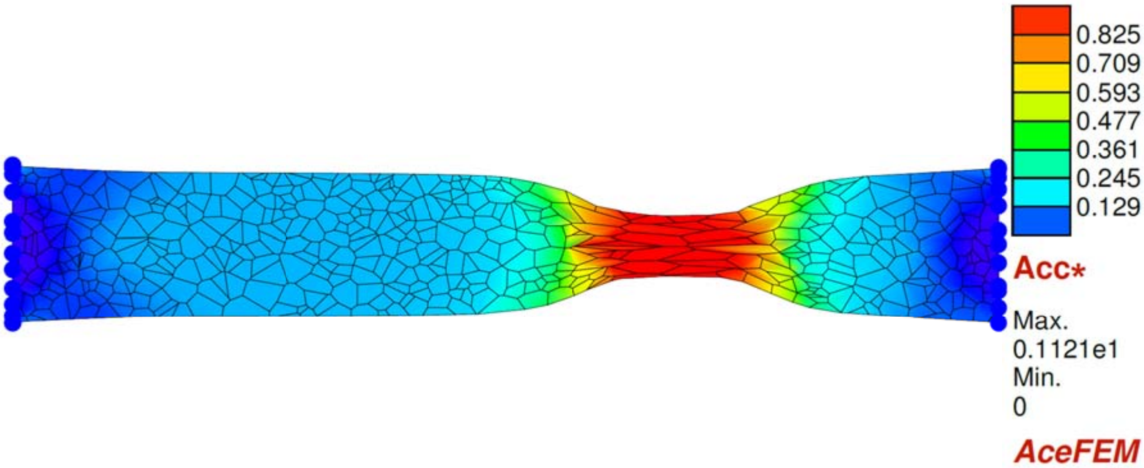

Figure 1. Deformed state and equivalent plastic strain.

This contribution is concerned with a simple low order virtual element formulation and its extension to different nonlinear problems that include inelastic material behaviour. Especially finite strain plasticity and phase field approaches are discussed in detail. Several possible formulations and discretization’s are introduced and compared by means of examples, see e.g. Fig. 1 that shows the necking deformation state of a bar for finite strain inelastic material behaviour using an irregular shaped Voronoi mesh.

In order to show the applicability of the virtual element method to multi-field problems, a phase field formulation for VEM is developed that allows the investigation of fracturing solids. Figure 2 depicts the crack propagation using a phase field approach based on a VEM simulation with a Voronoi mesh.

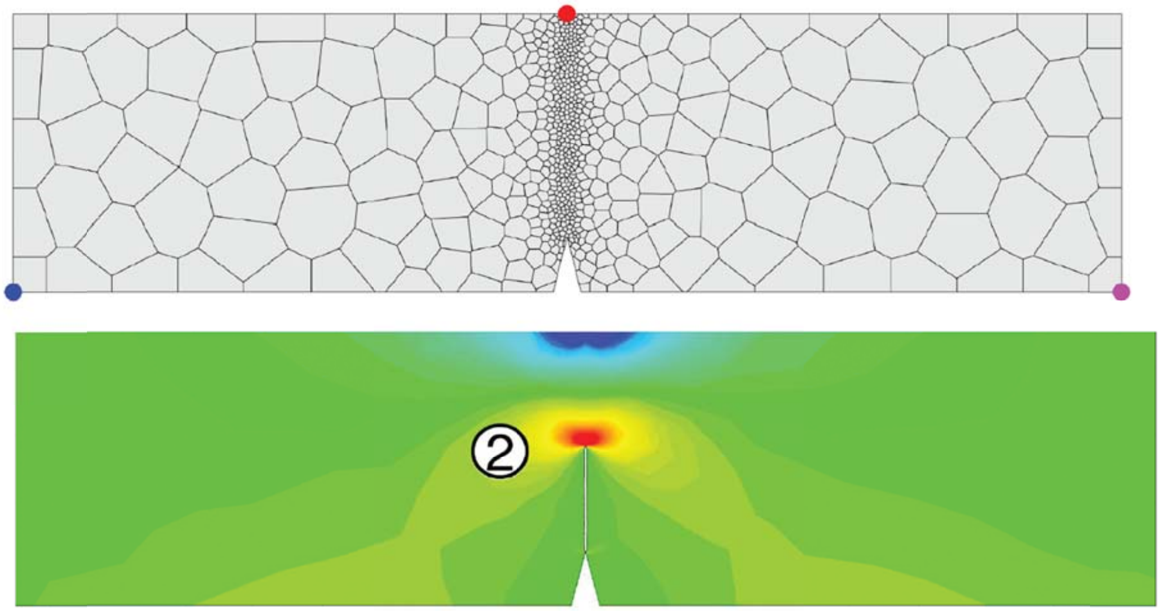

Figure 2. Mesh and crack propagation with phase field VEM.