# A mixed XFEM formulation for the simulation of ductile fractures

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## ABSTRACT

In metal plasticity the plastic deformation in general is isochoric. When using finite elements, this may lead to locking effects for larger plastic strains. In the past it could be shown that lower order mixed finite element formulations can alleviate this drawback.

In this contribution we present a mixed extended finite element formulation for the simulation of ductile behaviour of cracks that is locking free also for larger plastic strains. The chosen material model is von Mises plasticity. The XFEM formulation is based on the well known Q1P0 element formulation, and it includes enrichments for the displacement field as well as for the volumetric stress field [1, 2]. On the element level a static condensation procedure is applied such that compared to the standard XFEM no additional degrees of freedom are necessary. The properties of the mixed XFEM formulation are compared to standard XFEM approaches by means of numerical examples and convergence studies.

## REFERENCES

[1] Legrain, G. and Moes, N. and Huerta, A. Stability of incompressible formulations enriched with X-FEM. *Comput. Methods Appl. Mech. Engrg.* (2008) **197**:1835–1849.

[2] Loehnert, S. A mixed extended finite element formulation for the simulation of cracks in nearly incomressible materials. *Proceedings in Applied Mathematics and Mechanics* (2018) DOI: 10.1002/pamm.201800452.