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3D Crack modeling with XFEM in a finite elasto-plasticity framework

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ABSTRACT

In industrial forming processes the plastic deformation is used to manufacture components with demanding shapes. Since this process involves finite deformations the elasto-plastic constitutive law is formulated in a finite strain regime. In order to consider the most important phenomenological effects, a plasticity model with isotropic and nonlinear kinematic hardening analogous to [3] is used. The forming process furthermore initiates micro cracks and makes them grow. The overall aim is to simulate the initiation and growth of cracks on the microscale in future. As a first step a static crack is modeled by the XFEM under finite deformation as in [4] considering the inelastic constitutive law. From linear fracture mechanics one knows about the stress singularity at the crack tip. For elasto-plastic materials this singularity does not occure and the classical branch function for linear elastic fracture mechanics can not be used to model the characteristics of the displacement field. That's why a set of reduced basis function will be compared with already established ones as presented in [1] or in [2].

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