SPACE-TIME ANSATZ FOR PLASTICITY

HENRIK SCHNEIDER*

ABSTRACT

An approach for a space-time formulation for a variational inequality was developed by Glas and Urban [2] for a first kind parabolic variational inequality. They showed that a inf-sup condition and weak coercivity condition were sufficient to gain well-posedness. The plasticity problem is a mixed kind variational inequality since the presents of a convex set and a non-differentiable functional and therefore needs special treatment. We reformulate the quasi-static plasticity problem [1] in a space-time problem. Find $u \in U = \{v \mid v \in L^2(0,T;W), \dot{v} \in L^2(0,T;W'), v(0,x) = 0\}$ such that

$$A(u, v - \dot{u}) + J(v) - J(\dot{u}) \geq L(v - \dot{u}) \quad \forall v \in V = L^2(0,T;W).$$

While the continuous formulation inherits its existence and uniqueness properties from the quasi-static case, a new criterion must be found for the discretization. So we will discuss conditions for the well-posedness of the discrete plasticity problem. Also, the discrete space should not rely on a tensorial structure like in [3] and so enable the use of unstructured meshes.

References

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[2] S. Glas, K. Urban. *On noncoercive variational inequalities*, SIAM J. Numer. Anal. (2014).

[3] O. Steinbach. *Space-Time Finite Element Methods for Parabolic Problems*, Comput. Methods Appl. Math. (2015).

* Universität Duisburg-Essen, henrik.schneider@uni-duisburg-essen.de