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RATE-DEPENDENT REGULARIZATION FOR MATERIAL SOFTENING BASED ON ENERGY RELAXATION

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Standard local rate-independent constitutive models are known to show a pathological mesh dependence in the case of strain softening as far as the finite element method is concerned. Mathematically, this is related to the loss of ellipticity of the underlying partial differential equation (in the case of statics). If energy-based constitutive models such as those in [1] and [4] are considered, the aforementioned loss of ellipticity can be conveniently analysed by analysing the convexity properties of an incrementally defined potential. Furthermore, by replacing this incrementally defined potential by a certain convex hull, the resulting model does not show the described mathematical problems any more. Unfortunately, a straightforward computation of a certain convex hull leads to a completely different constitutive model, which does not show strain-softening at all, cf. [2]. An alternative was recently presented in [3]. The model in [3] is based on energy-relaxation, combined with a rate-dependency. In the present talk, the model in [3] is: (a) further developed such that the number of involved model parameters can be reduced (b) numerically implemented in an efficient manner and (c) analysed with respect to: (i) well-posedness and (ii) prediction of physical properties such as the fracture energy.

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