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A DISPLACEMENT-BASED GRADIENT-ENHANCED DAMAGE MODEL WITH TRANSIENT LENGTH SCALE

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It is widely recognized that a constant length scale parameter in integral and differential non-local damage models leads to an incorrect representation of failure mechanisms either by spurious damage growth [1] or by incorrect damage initiation and propagation [2].

In this contribution we present a transient length scale extension of the displacement-based gradient-enhanced damage model proposed by Rodrìguez-Ferran et al. [3]. The formulation of the proposed extension is elucidated and examples of the new model's regularization capabilities are compared to the original model with constant length scale. Contrary to similar extensions in classical gradient-enhanced damage models, the performance of the model is flawless. We will show that the adoption of a transient length scale activity, here linked to the damage field, enables an efficient and robust implementation that solves the issues of the standard model: spurious damage growth is removed and realistic damage initiation and propagation are guaranteed. Together with the computational efficiency typical of a properly linearized constitutive model (quadratic convergence), these features enable the representation of failure patterns typically obtained with phase field models (i.e., thin crack-like damage bands) without the typical complications.

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