Consistent nonlocal tangent operator for damage-plasticity model

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Realistic description of the mechanical behavior of quasibrittle materials requires constitutive laws with softening. However, standard models cannot be used after loss of ellipticity, which leads to an ill-posed mathematical problem. From the numerical point of view, ill-posedness is manifested by pathological sensitivity of the results to the size of finite elements. One of possible remedies is regularization by a nonlocal formulation based on a spatial averaging procedure.

In this contribution, a model combining anisotropic elasticity and anisotropic plasticity with isotropic damage is presented and regularized by the over-nonlocal formulation. Computational advantages of this approach are discussed and a fully consistent nonlocal tangent operator, which is needed to achieve quadratic rate of convergence of the Newton-Raphson method, is derived