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An elastoplastic analysis of gradient-dependent plasticity using the meshfree node-based smoothed radial point interpolation method

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This paper presents an elastoplastic analysis for the simulation of gradient-dependent plasticity in 2D solids using the meshfree node-based smoothed radial point interpolation method (NS-RPIM), which is based on the parametric variational principle (PVP) in the form of linear complementarity. In the algorithm, the gradient-dependent plasticity is represented by means of the linearization of the yield criterion and the flow rule. The yield stress is linearly evolved through equivalent plastic strain as well as its Laplacian (namely second gradient). The global discretized system equations are transformed into a standard linear complementarity problem (LCP), which can be solved readily using the Lemke method. The proposed approach is capable of simulating material hardening/softening and strain localization. An extensive numerical study is performed to validate the proposed method and to investigate the effects of the various parameters used in the computational model. The numerical results demonstrate that the proposed approach can provide accurate and stable results for the 2D elastoplastic analysis with gradient-dependent plasticity.

Keywords: Elastoplastic analysis; gradient-dependent plasticity; meshfree method; node-based gradient smoothing, radial point interpolation method