Reliable and fast Solving of Small-Strain Plasticity Problems with a Nonsmooth Multigrid Method

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We present a new approach for solving small-strain plasticity problems called the *Truncated Nonsmooth Newton Multigrid Method* (TNNMG). It is based on the primal form of the plasticity problem, where the unknowns are the *displacement* and the *plastic strain*. Time discretization results in a sequence of convex minimization problems. It works both for smooth and nonsmooth yield laws, as well as for various linear and nonlinear hardening rules.

TNNMG is designed to minimize such convex functionals with block-separable nonlinearities by combining local nonlinear smoothing steps and global linear multi grid corrections. TNNMG has been proven to be *globally convergent*, and is extremely fast in practice: With this method we can compute a complete plasticity time step in less time than one classical predictor–corrector step.

In the presentation the TNNMG method will be explained and applied to rate-independent small-strain plasticity theory. Several numerical simulations will be given for *Tresca* and *Von Mises* yield laws as well as for different hardening rules. The efficiency of the algorithm will be compared to the predictor–corrector approach.

References:

[1] O. Sander, *Solving primal plasticity increment problems in the time of a single predictor-corrector iteration*, https://arxiv.org/abs/1707.03733

[2] C. Gräser and O. Sander, *Truncated Nonsmooth Newton Multigrid Methods for Block-Separable Minimization Problems*, https://arxiv.org/abs/1709.04992

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