Truncated Nonsmooth Newton multigrid methods for vector valued minimization problems

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The extension of the classical Gauß–Seidel method to scalar problems with separable nonsmooth terms is straight forward. In contrast to this vector valued block separable problems demand for smoothers with local solvers tailored to the structure on the nonsmooth terms. Similarly the construction of coarse grid corrections has to take care on this structure.

We will present truncated nonsmooth Newton multigrid (TNNMG) methods that rely on nonlinear inexact block Gauß–Seidel smoothers and linear coarse grid corrections derived using ideas from nonsmooth analysis. While the performance and efficiency of TNNMG is comparable to linear multigrid it is more flexible and easier to implement than other schemes. Numerical examples from applications in material science, continuum mechanics, and glacier modeling show the flexibility, efficiency, and robustness of this approach.