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Energy minimization in parallel setting

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The linear systems arising from multi-physics simulations may present significant challenges for traditional algebraic multigrid (AMG) solvers. AMG methods based on energy minimization prove to be an effective approach to some of these problems. The flexibility of these methods is based on two components: an *a priori* chosen nonzero pattern of a prolongator, and interpolation of low energy modes, both of which act as constraints in an optimization problem. The parallel solution of this constrained problem presents some practical challenges, e.g. how to handle situations where the problem is over-constrained, or when the nonzero pattern is non-local. In this talk, we discuss a parallel implementation of energy minimization AMG, developed using a flexible parallel multigrid framework called MueLu, part of the Sandia Trilinos project. We discuss the challenges, and demonstrate that the resulting algorithms are effective and scalable on challenging problems.