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Compatible Relaxation and Coarsening in Algebraic Multigrid

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Algebraic multigrid (AMG) has been shown to be an efficient iterative solver for many of the large and sparse linear systems arising from the discretization of partial differential equations. There remain, however, many classes of problems for which conventional AMG setup algorithms, based on the properties of M-matrices, are inappropriate. In this talk, we consider the use of compatible relaxation (CR) as a tool for extending the applicability of AMG. A CR-based coarsening algorithm is presented along with numerical results demonstrating that the variational multigrid solver resulting from the proposed approach maintains multigrid-like optimality, without the need for parameter tuning, for some problems where current algorithms exhibit degraded performance.