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Support Graph Smoothing Techniques

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Many tasks in large-scale network analysis and simulation require efficient approximation of the solution to the linear system $Lx = b$, where L is a graph Laplacian. However, due to the large size and complexity of scale-free graphs, standard iterative methods do not perform optimally. The use of support graph techniques for preconditioning graph Laplacian systems has been studied, but efficiently finding optimal preconditioners is challenging for general scale-free graphs. An attractive option is to use support graphs in conjunction with algebraic multigrid to precondition the graph Laplacian system. We employ a tree-based support graph technique as a smoother for Lean Algebraic Multigrid with aggressive coarsening. We present a preliminary numerical study demonstrating that the support graph smoother coupled with complementary aggressive coarsening should be an optimal solver.