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Algebraic Multilevel Preconditioner based on Matching for Graph Laplacians

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We consider a special coarse space definition for an algebraic multilevel preconditioner using matching in graphs. The convergence of the resulting multilevel method will be discussed. Although not fully optimal, the method has some attractive properties, such as: preserving the sparsity of the coarse level matrices and preserving the M-matrix property. The convergence estimate relays on the stability of suitable projections onto the coarse spaces. Such stability estimate will be derived using a new approach, namely, the commuting properties of these projections with discrete (graph) analogue of the gradient.