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On Multiplicative and Additive Multigrid Schemes for Sparse Eigenproblems

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Multiplicative multigrid algorithms have recently been shown to be powerful and robust, mainly as pure eigen-solvers or as a setup phase for adaptive linear system solvers. However, such multiplicative algorithms have one significant drawback, in that they require recalculating the whole multigrid hierarchy of operators in each cycle, entailing a relatively high computational cost. This work suggests a scheme where multiplicative and additive algorithms are applied in a complementary manner, with the multiplicative solver providing the coarse-grid hierarchy to the additive algorithm, and getting in return an improved solution with which to construct better operators. This approach is demonstrated with two new and improved versions of the recent adaptive Smoothed Aggregation multiplicative method for solving Markov Chains.