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**Least-squares Based Multilevel Eigensolvers for Markov  
Chain Applications**

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To guarantee efficient performance of algebraic multilevel methods for solving the eigenproblem  $Bx = x$  in Markov Chain applications, we are using an adaptive setup that captures the nature of the eigenmode of interest. The least-squares based approach computes appropriate testfunctions and fits them to define highly accurate interpolation that leads to a robust multilevel performance. The algorithm iteratively improves the ability of the multi-level approximation To the lowest mode of interest until it can be efficiently resolved using this hierarchy as preconditioner to an additive GMRES step. We test the proposed approach for a variety of applications, showing promising results over a wide range of tests.