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Exploring Eigenvector Localization Using Filtered Subspace Iteration (FEAST)

Domain geometry and properties of the coefficients of selfadjoint elliptic operators can cause certain eigenvectors to be highly localized in relatively small subdomains. Such localization phenomena have generated a lot of interest in the physics and mathematics communities since the late 1950s, but the underlying mechanisms driving localization are still not fully understood, despite advances on the mathematical side during the last decade. Computational approaches for identifying likely regions of localizations and approximating localized eigenvectors and/or their corresponding eigenvalues have emerged in the past two years. We present a new approach in which filtered subspace iteration is applied to a perturbed version of the selfadjoint operator, where the complex perturbation is chosen to highlight eigenvectors that are localized in a user-specified region. Preliminary theoretical and computational results will be presented.