Summary: As we know, polynomial filtering technique is efficient for accelerating convergence of standard eigenvalue problems, which, however, has not appeared for solving generalized eigenvalue problems. In this paper, by integrating the effectiveness and robustness of the Chebyshev polynomial filters, we propose the Chebyshev-Davidson method for computing some extreme eigenvalues and corresponding eigenvectors of generalized matrix pencils. In this method, both matrix factorizations and solving systems of linear equations are all avoided. Convergence analysis indicates that the Chebyshev-Davidson method achieves quadratic convergence locally in an ideal situation. Furthermore, numerical experiments are carried out to demonstrate the convergence properties and to show great superiority and robustness over some state-of-the-art iteration methods.

MSC:

65F15 Numerical computation of eigenvalues and eigenvectors of matrices

Keywords:
generalized eigenvalue problem; Davidson method; Chebyshev polynomial; symmetric matrix

Software:

FEAST; eigs; lobpcg.m; JDQR; IRAM; EIGIFP; JDQZ

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References:


Li, Y.-Z., Yang, H.-Z.: Spectrum slicing for sparse Hermitian definite matrices based on Zolotarev’s functions. arxiv:1701.08935


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