Strategies for spectrum slicing based on restarted Lanczos methods

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In the context of symmetric-definite generalized eigenvalue problems, $Ax = \lambda Bx$, it is often required to compute all eigenvalues contained in a prescribed interval. Research in this topic culminated with the paper by Grimes *et al.* [1], where a robust and efficient procedure is proposed. This technique, usually referred to as spectrum slicing, combines several ingredients: (1) unrestarted block Lanczos method with B-orthogonalization, (2) shift-and-invert spectral transformation, *i.e.*, to solve $(A - \sigma B)^{-1}Bx = \theta x$ for a given shift σ, (3) dynamic shift selection, and (4) use of inertia information to determine the number of eigenvalues in a given subinterval. Nowadays, robust Krylov methods are based on restarted variants such as the thick-restart Lanczos method [2]. We propose an updated spectrum slicing methodology that relies on such variants, and explore several strategies for shift selection, locking, enforcement of multiplicity, etc. Our aim is to provide an industrial-strength parallel implementation in SLEPc [3].

References

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