

An efficient and robust restart strategy is important for any Krylov-based method for eigenvalue problems. The tensor infinite Arnoldi method (TIAR) [2] is a Krylov-based method for solving nonlinear eigenvalue problems (NEPs). This method can be interpreted as an Arnoldi method applied to a linear and infinite dimensional eigenvalue problem where the Krylov basis consists of polynomials. We propose new restart techniques for TIAR [1] and analyze efficiency and robustness. More precisely, we consider an extension of TIAR which corresponds to generating the Krylov space using not only polynomials but also structured functions [3] that are sums of exponentials and polynomials, while maintaining a memory efficient tensor representation. We propose two restarting strategies, both derived from the specific structure of the infinite dimensional Arnoldi factorization. One restarting strategy, which we call semi-explicit TIAR restart, provides the possibility to carry out locking in a compact way. The other strategy, which we call implicit TIAR restart, is based on the Krylov-Schur restart method for linear eigenvalue problem and preserves its robustness. Both restarting strategies involve approximations of the tensor structured factorization in order to reduce complexity and required memory resources. We bound the error in the infinite dimensional Arnoldi factorization showing that the approximation does not substantially influence the robustness of the restart approach. We illustrate the approaches by applying them to solve large scale NEPs that arise from a delay differential equation and a wave propagation problem. The advantages in comparison to other restart methods are also illustrated.

References

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