

Rational Approximation for the Inverse of a ϕ -Function of Quasiseparable Matrices

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Abstract

Rational approximation in the form of a partial fraction expansion is especially well-suited to the computation of functions of structured matrices, when such matrices can be inverted cheaply. Here we focus on the inverse of the ϕ_1 function

$$\psi_1(z) = \phi_1(z)^{-1} = \frac{z}{e^z - 1}$$

which is involved in the solution of certain linear differential equations.

We introduce a family of mixed polynomial-rational approximations of $\psi_1(z)$ with the goal of

- computing solutions of the differential problems mentioned above, in the form $\psi_1(A)g$, where A is a quasiseparable matrix and g a vector,
- reconstructing the matrix $\psi_1(A)$.

Numerical experiments illustrate the behavior and the benefits of such an approach.

References

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- [2] P. Boito, Y. Eidelman, L. Gemignani, *Computing the Inverse of a ϕ -Function by Rational Approximation*, arXiv: 1801.04573 [math.NA].