

Efficient computation of the core functions of exponential integrators

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Abstract

In the framework of the exponential integrators for parabolic problems, we provide a complete analysis concerning the use of the Restricted-Denominator rational Arnoldi method for the computation of the matrix ϕ -functions. In particular we derive reliable and easy to use a-posteriori error estimates together with an accurate analysis about the choice of the pole of the rational approximation. We assume that the matrix we are dealing with (the Jacobian of the system or an approximation of it) represents an unbounded sectorial operator. The angle of the sector is the only information required to derive the error bounds. We also provide some hints for an efficient implementation of the method inside an exponential integrator with a discussion of what happens in the case of a non-optimal choice of the pole.