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Efficient computation of the sinc matrix function for the integration of second-order differential equations

In this poster [1], we deal with the numerical solution of systems of oscillatory second-order differential equations which often arise from the space semi-discretization of partial differential equations. Since these differential equations exhibit (pronounced or highly) oscillatory behavior, standard numerical methods are known to perform poorly. Our approach consists in directly discretizing the problem by employing Gautschi-type integrators [2] based on sinc matrix functions. The novelty contained here is that of using a suitable rational approximation formula for the sinc matrix function to apply a rational Krylov-like approximation method with suitable choices of poles. In particular, we discuss the application of the whole strategy to a finite element discretization of the wave equation.

[1] L. Aceto, F. Durastante. Efficient computation of the sinc matrix function for the integration of second-order differential equations, In preparation,
[2] W. Gautschi, Numerical integration of ordinary differential equations based on trigonometric polynomials, Numer. Math. 3 (1961) 381–397.

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