Johann Radon Institute for Computational and Applied Mathematics Austrian Academy of Sciences (ÖAW)

Group Seminar

Computational Methods for PDEs

On Rational Krylov and Reduced Basis Methods for Fractional Diffusion

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Tuesday, April 27, 2021, 15:30
ZOOM

Abstract

We establish an equivalence between two classes of methods for solving fractional diffusion problems, namely, Reduced Basis Methods (RBM) and Rational Krylov Methods (RKM). In particular, we demonstrate that several recently proposed RBMs for fractional diffusion can be interpreted as RKMs. This changed point of view allows us to give convergence proofs for some methods where none were previously available.

We also propose a new RKM for fractional diffusion problems with poles chosen using the best rational approximation of the function z^{-s} with z ranging over the spectral interval of the spatial discretization matrix. We prove convergence rates for this method and demonstrate numerically that it is competitive with or superior to many methods from the reduced basis, rational Krylov, and direct rational approximation classes. We provide numerical tests for some elliptic fractional diffusion model problems.

We also present a unified theoretical and analytical approach to deduce RKMs for parabolic fractional diffusion problems making use of the abstract framework of Stieltjes and complete Bernstein functions. We discuss both existing and novel pole selection strategies and demonstrate their performance in some numerical tests.

online: ZOOM

Tue, Apr 27, 2021 03:30 PM (CET)

`https://jku.zoom.us/j/98685485631?pwd=SE41bjRuZHdZa2Y0K1FoaGd3NUJWZz09`

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