Dynamical low-rank approximation for parabolic problems

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Dynamical low-rank approximation is a framework for time integration of matrix valued ODEs on a fixed-rank manifold based on a time dependent variational principle. Several applications arise from PDEs on product domains, but setting up a corresponding well-posed problem in function space (before discretization) may not be straightforward. Here we present a weak formulation of dynamical low-rank approximation for parabolic PDEs in two spatial dimensions. The existence and uniqueness of weak solutions is shown using a variational time-stepping scheme on the low-rank manifold which is related to practical methods for low-rank integration.

Joint work with: Markus Bachmayr, Henrik Eisenmann, and Emil Kieri.

References

[1] M. Bachmayr, H. Eisenmann, E. Kieri, and A. Uschmajew. Existence of dynamical low-rank approximations to parabolic problems. *Mathematics of Computation*, 90(330):1799–1830, 2021.