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"ADI for Tensor Structured Equation"

Abstract:

We will present an extension of the well known ADI method for the solution of Lyapunov equations

$$FX + XF^T = -GG^T \quad (1)$$

to higher dimensional problems. The vectorized form of the Lyapunov equation is

$$I \otimes F + F \otimes I \text{vec}(X) = \text{vec}(B).$$

We consider the generalization of this equation of the form

$$\text{Avec}(X) = (I \otimes \dots \otimes I \otimes A_1 + I \otimes \dots \otimes I \otimes A_2 \otimes I + \dots + A_d \otimes I \otimes \dots \otimes I) \text{vec}(X) = \text{vec}(B).$$

The tensor train structure is one possible generalization of the low rank factorization we find in the right hand side of (1). Therefore we assume B to be of tensor train structure. We show that in analogy to the low rank ADI case the solution X can be generated in tensor train structure, too. Further we provide an algorithm that computes X using a generalization of the ADI method.

This is joint work with Jens Saak.