On Low-rank Updates of Matrix Functions

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The efficient and reliable update computation of large-scale matrix functions subject to low-rank perturbations is of interest in several applications, such as the analysis of networks. For addressing this problem, Beckermann and Kressner have proposed the use of tensor polynomial and rational Krylov subspace methods. Starting from the exactness property of (rational) Krylov subspaces, convergence bounds for the tensor Krylov subspace method have been derived. In this talk, we discuss how these bounds provide important insight into the choice of poles for setting up the rational Krlyov subspaces. In particular, we discuss $\exp(A)$ and $\mathrm{sign}(A)$. The matrix sign function immediately yields the corresponding spectral projector and we discuss how tensorized Krylov subspace methods can be used in the solution of eigenvalue problems. For the case of the matrix exponential, the error expansion in terms of $\varphi-$ functions as well as the resulting corrected scheme proposed by Saad are extended to the tensor Krylov subspace method. While the corrected scheme itself may not offer advantages, it has been observed useful in deriving stopping criteria.