1 Exponential Integrators for Solving Large-Scale Differential Riccati Equations

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The differential Riccati equation (DRE) arises in several applications, especially in control theory. Partial differential equations (PDEs) constraint optimization problems often lead to formulations as abstract Cauchy problems. Imposing a quadratic cost functional, the resulting optimal control is solved by a feedback control where the feedback operator is given in terms of an operator-valued DRE. Hence, in order to apply such a feedback control strategy to PDE control, we need to solve the large-scale DREs resulting from a spatial semi-discretization. There is a variety of methods to solve DREs. One common approach is based on a linearization that transforms the DRE into a linear Hamiltonian system of first-order matrix differential equations. The analytic solution of this system is given in terms of the exponential of a 2nx2n Hamiltonian matrix. In this talk, we investigate the use of symplectic Krylov subspace methods to approximate the action of this operator and thereby solve the DRE. Numerical examples illustrating the performance of the method will be shown.