PRINCIPAL PIVOT TRANSFORMS, STRUCTURED MATRICES, AND MATRIX EQUATIONS

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Principal pivot transforms are maps between matrices that generalize, in some sense, Schur complementation and inversion. They are a somewhat counterintuitive but powerful tool that allows one to reinterpret Gaussian elimination-type algorithms in a different framework.

We will show how they can deal successfully with various kinds of matrices in a structure-preserving way; this includes saddle-point matrices, i.e., symmetric matrices with two complementary diagonal blocks of opposite definiteness, as well as Hamiltonian/symplectic matrices. One can preserve not only symmetry properties, but also semidefiniteness ones and update certain low-rank factorizations of the blocks. We will then present an algorithm to solve algebraic Riccati equations relying on these transforms as a basic building block.

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