Volker Mehrmann and modern factorizations of symplectic matrices

Froilán M. Dopico[1]

[1]Departamento de Matemáticas, Universidad Carlos III de Madrid. dopico@math.uc3m.es

Theory and structured algorithms concerning symplectic matrices are among main Volker's research interests along his whole career. Many of his papers and books contain results and algorithms related to this fundamental group of matrices and its applications to systems and control theory, as well as to classical mechanics and Hamiltonian dynamical systems, see for instance [6, 7, 5] and many other references therein. A technique that Volker has very often used in his theoretical and numerical work on symplectic matrices is to factor a general symplectic matrix into finite products of simpler symplectic matrices that reveal important properties of the original symplectic matrix. This strategy has deeply influenced the research in this area (see [3] and the references therein) and, in particular, a simple but fundamental symplectic factorization lemma proved by Volker in late 1980's was the starting point of my papers [1, 2]. In addition, this symplectic factorization strategy is also the main thread of the unpublished survey-biased manuscript [4], coauthored by Steven Mackey, Nil Mackey, and Volker, which is also closely connected with [1, 2]. This talk has to main purposes: first, to summarize some key factorizations of symplectic matrices developed by several authors since the 1980's, with special attention to those included in [1, 2, 4]; and, second, to encourage Steven Mackey, Nil Mackey, and Volker to finish and submit the manuscript [4].

References

[1] F. M. Dopico and C. R. Johnson, *Complementary bases in symplectic matrices and a proof that their determinant is one*. Linear Algebra Appl., 419 (2006), pp. 772–778.

[2] F. M. Dopico and C. R. Johnson, *Parametrization of the matrix symplectic group and applications*. SIAM J. Matrix Anal. Appl., 31 (2009), pp. 650–673.

[3] H. Fassbender, *Symplectic methods for the symplectic eigenproblem*. Kluwer Academic/Plenum Publishers, New York, 2000.

[4] D. S. Mackey, N. Mackey, and V. Mehrmann, *Symplectic factorizations and the determinant of symplectic matrices*. Unpublished manuscript.

[5] W.-W. Lin, V. Mehrmann, and H. Xu, *Canonical forms for Hamiltonian and symplectic matrices and pencils*. Linear Algebra Appl., 302-303 (1999), pp. 469–533.

[6] V. Mehrmann, *A symplectic orthogonal method for single input or single output discrete time optimal quadratic control problems*. SIAM J. Matrix Anal. Appl., 9 (1988), pp. 221–247.

[7] V. Mehrmann, *The Autonomous Linear Quadratic Control Problem*. Lecture Notes in Control and Inform. Sci. 163, Springer-Verlag, Berlin, 1991.