Adaptive rational Krylov subspaces for large-scale dynamical systems

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The rational Krylov space is recognized as a powerful tool within Model Order Reduction techniques for linear dynamical systems. However, its success has been hindered by the lack of a parameter-free procedure, which would effectively generate the sequence of shifts used to build the space. In this talk we propose an adaptive computation of these shifts. The whole procedure only requires to inject some initial rough estimate of the spectral region of the matrix, while further information is automatically generated during the process. The approach is a full generalization to the nonsymmetric case of the idea first proposed in [1], and we show that it can used for two important problems in control: the approximation of the transfer function and the numerical solution of large Lyapunov equations. The procedure can be naturally extended to other related problems, such as the solution of the Sylvester equation, and parametric or higher order systems. Numerical experiments will be shown to assess the quality of the rational projection space over its most natural competitors.

References

[1] V. Druskin, C. Lieberman, and M. Zaslavsky. *On adaptive choice of shifts in rational Krylov subspace reduction of evolutionary problems.* Technical report, Schlumberger-Doll Research, 2009.