M-M.E.S.S. 3.0 - Introducing Krylov-based solvers

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Matrix equations have many important applications in Model Order Reduction (MOR). Lyapunov and Riccati equations are the central ingredients in balancing based methods and Sylvester equations are related to eigenvalue problems in modal approximations, and in certain cases their solutions span the rational Krylov subspaces sought in interpolatory MOR. Especially when large-scale dynamical systems are treated, the coefficients become large, and are usually sparse. In these settings, the solutions to the equations are observed to often have low (numerical) rank and, thus, low-rank approximations to the solution are of central interest. M-M.E.S.S. [2] provides solvers that iterate directly on the low-rank factors of the solutions.

Classically, the solvers in M-M.E.S.S. have been centered around the low-rank ADI iteration. The latest version additionally supports methods based on projection to extended and rational Krylov subspaces [3, 4]. Moreover, a specialized method for Sylvester equations with tall and skinny solutions [1] was added.

On the poster, we show how these benefit MOR and embed in the general structure of the toolbox.

References

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