Linear-Quadratic Gaussian Balancing for Model Reduction of Descriptor Systems

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One of the most popular model order reduction methods is standard balanced truncation model order reduction. This method is based on the solution of two (dual) Lyapunov equations and unfortunately only applies to asymptotically stable systems.

One alternative method in the class of balanced truncation model reduction methods is linear-quadratic Gaussian (LQG) balanced truncation [1]. This method is based on the solution of two (dual) algebraic Riccati equations and in contrast to standard balanced truncation is not limited to asymptotically stable systems.

In this talk, we discuss LQG balanced truncation for descriptor systems. Therefore we consider the descriptor system as a whole and do not decouple the differential and algebraic part. The presented method is based on the generalized algebraic Riccati equations of type

\[ 0 = A^T X + X^T A - X^T B B^T X + C^T C, \quad E^T X = X^T E, \]
\[ 0 = A Y^T + Y A^T - Y C^T C Y^T + B B^T, \quad E Y^T = Y E^T. \]

This type of equations has been considered in [2]. In the first part of this talk, we give a new solvability criteria for this type of equation in terms of systems theoretic properties. In the second part, we introduce the LQG balanced truncation method and present an error bound in the gap metric.

References
