On error estimates for reduced models obtained by balanced truncation

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A priori error bounds have been derived for different balancing-related model reduction methods. The most classical result is a bound for balanced truncation and singular perturbation approximation that is applicable for asymptotically stable linear time-invariant systems with homogeneous initial conditions. Recently, there have been a few attempts to generalize the balancing-related reduction methods to the case with inhomogeneous initial conditions [1, 2], but the existing error bounds for these generalizations are quite restrictive. Particularly, it is required to restrict the initial conditions to a low-dimensional subspace, which has to be chosen before the reduced model is constructed. In the contribution [3], we propose an estimator that circumvents this hard constraint completely. Our estimator is applicable to a large class of reduction methods, whereas the former results were only derived for certain specific methods. Moreover, our approach yields to significantly more effective error estimation, as also will be demonstrated numerically.
If time permits, we point towards the treatment of differential-algebraic equations and other potential extensions and implications of the new estimator.

References

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