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Perturbation theory for inexact Krylov-based model reduction reduction methods

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In this talk, we analyze the use of inexact solves in a Krylov-based model reduction setting and present the resulting structured perturbation effects on the underlying model reduction problem. We first illustrate that for a selection of interpolation points that satisfy first-order necessary H_2-optimality conditions, a primitive basis remains remarkably well-conditioned and errors due to inexact solves do not tend to degrade the reduced order models.

We show that when inexact solves are performed within a Petrov-Galerkin framework, the resulting reduced order models are backward stable with respect to the approximating transfer function. As a consequence, Krylov-based model reduction with well chosen interpolation points is robust with respect to the structured perturbations due to inexact solves. General bounds on the H_2 system error associated with an inexact reduced order model are introduced that provide a new tool to understand the structured backward error and stopping criteria.