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Balanced truncation for parametric linear systems using interpolation of gramians: a comparison of linear algebraic and geometric approaches

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Abstract In balanced truncation model order reduction, one has to solve a pair of Lyapunov equations for the two gramians and uses them for constructing a reduced-order model. Although advances in solving such equations have been made, it is still the most expensive step in this reduction method. For systems that depend on parameters, parametric model order reduction has to deal with the dependence on parameters simultaneously with approximation of the input-output behavior of the full-order system. The use of interpolation in parametric model order reduction has become popular. Nevertheless, interpolation of gramians is rarely mentioned, most probably due to the restriction to symmetric positive semi-definite matrices. In this talk, we will present two approaches for interpolating these structured matrices which are based on linear algebra and a recently developed Riemannian geometry. The result is then utilized in constructing parametric reduced-order systems. Their numerical performances are compared on different models

Keywords Interpolation · Parametric model order reduction · Balanced truncation · interpolation · gramians · Riemannian matrix manifold · Symmetric positive semi-definite matrices of fixed rank

Mathematics Subject Classification (2000) 65D05 · 65F30 · 93C05 · notdoneyet

1 Introduction

I cite somebody here [1].

Address(es) of author(s) should be given

2 Brief balanced truncation for parametric linear systems and standard interpolation

2.1 Balanced truncation

2.2 Interpolation of gramians for parametric model order reduction

3 Manifold $\mathcal{S}_+(k,n)$ and its interpolation scheme

3.1 A quotient geometry of $\mathcal{S}_+(k,n)$

3.2 Curve and surface interpolation for parametric model order reduction

3.3 A note on imbedded geometry of $\mathcal{S}_+(k,n)$

4 Numerical examples

5 Conclusion

References

1. Absil, P.A., Mahony, R., Sepulchre, R.: Optimization Algorithms on Matrix Manifolds. Princeton University Press, Princeton, NJ (2008)