Error estimates for POD surrogate model based suboptimal control

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We present an error analysis for POD Galerkin approximations of optimal control problems governed by time dependent pdes. We obtain error estimates for POD suboptimal controls by combining error estimates for POD Galerkin aproximations of time dependent pdes obtained by Kunisch and the second author in [2], and a tailored discrete concept for optimal control problems developed by the first author in [3].

Taking into account the fact that snapshots related to optimal controls can not be computed in advance we present a method that in an adaptive manner constructs a hierachy of appropriate low dimensional approximations to the mathematical model which then are used as subsidiary condition in the related optimization problem. Finally, we present some numerical examples.

[1] M. Hinze and S. Volkwein: *Proper Orthogonal Decomposition Surrogate Models for Nonlinear Dynamical Systems: Error Estimates and Suboptimal Control*, Lecture Notes in Computational Science and Engineering 45:261-306, 2005

[2] K. Kunisch and S. Volkwein,: *Galerkin proper orthogonal decomposition methods for a general equation in fluid dynamics*, SIAM Journal on Numerical Analysis, 40:492-515, 2002

[3] M. Hinze: *A variational discretization concept in control constrained optimization: the linear-quadratic case*, J. Computational Optimization and Applications 30:45-63, 2005

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