ERROR ANALYSIS FOR POD APPROXIMATIONS IN A DYNAMIC PROGRAMMING FRAMEWORK

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Abstract. For nonlinear optimal control problems, feedback laws can be computed via the value function characterized as the unique viscosity solution to the corresponding Hamilton-Jacobi-Bellman (HJB) equation which stems from the dynamic programming approach. However, the bottleneck is mainly due to the course of dimensionality and HJB equations are only solvable in a relatively small dimension. Therefore, a reduced-order model is derived for the dynamical system and for this purpose we use the method of proper orthogonal decomposition (POD). We will apply these techniques to solve the infinite horizon optimal control problem for a nonlinear high-dimensional dynamical system. The resulting errors in the HJB equations are estimated via an a-priori error analysis, which suggests a new sampling strategy for the POD method. Numerical experiments will illustrate the proposed method.

Keywords: optimal control, dynamic programming, POD approximation, error estimates.

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