Model Reduction of Semistable Infinite-Dimensional Control Systems

Abstract

In this thesis, we extend parts of the framework available for model reduction of finite-dimensional stable control systems to an infinite-dimensional and semistable setting. To achieve our goals, we build upon results obtained [CKS17] where the authors find $\mathcal{H}_2$-Norm Error Estimates for the model reduction of finite-dimensional systems driven by a graph Laplacian. The difference between this and previous work is threefold: First, we consider infinite-dimensional systems as to include systems driven by Partial Differential Operators and we thus place earlier work in an appropriate Functional-Analytic setting. Second, we consider a broader class of exponentially semistable systems, not just those driven by a graph Laplacian. Third, we restrict to a class of model reductions which have a dynamic invariance with respect to their kernel and the semigroup associated to the system. For completeness, we also give a brief introduction to Semigroup Theory and provide background material from Functional Analysis. Throughout the text, the second derivative operator and heat equation on $[0, 1]$ are used as examples.