

Model Reduction of Dynamical Systems Exercise 5

19 June 2017

Problem 1. *PMOR using multi-moment matching*

Implement the parametric model order reduction (PMOR) using multi-moment matching as discussed in the course to reduce the heat equation:

$$\begin{aligned} \partial_t T(z, t) &= c \partial_{zz} T(z, t), & z \in (0, 1), t > 0, \\ T(z, 0) &= 0, & z \in (0, 1), \\ k \partial_z T(0, t) &= -u(t) + T(0, t), & t > 0, \\ k \partial_z T(1, t) &= -T(1, t), & t > 0, \\ y(t) &= T(1, t), & t > 0, \end{aligned}$$

discretized in space using finite difference method over a homogeneous mesh. Parameters are $c \in [0.1, 10]$ and $k \in [0.1, 10]$. Plot the \mathcal{H}_2 -norm of the original system over the parameter space. Compute and plot the \mathcal{H}_2 -error using multi-moments around $s = 0$, $c = 1$, and $k = 1$.

Problem 2. *PMOR using IRKA*

Implement the parametric model order reduction (PMOR) using IRKA as discussed in the course to reduce the discretized heat equation. Plot the \mathcal{H}_2 -error over the parameter space.