

## Model Reduction of Dynamical Systems Exercise 2

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**Problem 1.** *Model reduction by balanced truncation*

In this exercise we shall consider the Model reduction of LTI systems of the form,

$$\Sigma : \begin{cases} \dot{x}(t) &= Ax(t) + Bu(t), \\ y(t) &= Cx(t) + Du(t) \end{cases}$$

- (a) Implement the balanced truncation method to obtain the reduced order model for the clamped beam model (`beam.mat`) [1]. Plot the transfer function of the full and reduced system between the frequency range  $\omega \in [10^{-3}, 10^3]$ .
- (b) Plot the error in the approximation over the frequency range, for a given order of the reduced system. Determine the  $\mathcal{H}_\infty$  error between the original and reduced transfer functions. Is this error in accordance to the error bound for balanced truncation introduced in the lecture?

## References

- [1] <http://slicot.org/20-site/126-benchmark-examples-for-model-reduction>.