RECENT ADVANCES IN MODEL ORDER REDUCTION OF NON-LINEAR SYSTEMS: A PROSPECTIVE FROM EARLY STAGE RESEARCHERS

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ABSTRACT

Non-linear systems exhibit much more intricate and complex behaviors compared to their linearized counterparts. In numerous research and industrial scenarios, understanding these behaviors often requires computationally intensive numerical solutions using finely discretized models. Unfortunately, this approach leads to significant memory and time requirements, which can impede analysis, design, and optimization processes. To address these challenges, model order reduction (MOR) techniques come into play, facilitating the aforementioned tasks by creating lower-order approximations of the high-fidelity model.

Substantial improvements have been achieved in this field over the past years. Interpolation methods for non-linearties [1] and hyper-reduction approaches [4] have been proposed by the reduced basis community. Reduction of specific classes of non-linear input-output maps, such as bilinear control system [3] and quadratic-in-state system [2], have been successfully addressed in the system theoretic framework. Despite this, there are several challenges when dealing with reduced order models approximating non-linear systems. One of the challenges is error certification, as ensuring the accuracy of these reduced models is a difficult task [5]. Additionally, another challenge is the lack of generalization. Some model reduction techniques may perform well for specific non-linear systems but struggle to be effective across different types of non-linear problems.

The aim of this minisymposium is to bring together early-stage researchers to present recent advancements of MOR for non-linear systems. In particular we encourage participation from both the reduced basis and system-theoretic communities.

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