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A Posteriori Error Estimation and Adaptivity for Model Order Reduction of Large-Scale Systems

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We study a posteriori error estimation and adaptivity with the goal of automatic model order reduction of large-scale systems. We propose efficient offline adaptive techniques that are aimed at (a) bringing down the significant offline cost often associated with generating reduced-order models and (b) minimizing the user interference in obtaining efficient reduced-order models. Adaptivity is considered in two aspects: adaptive basis enrichment and adaptive training set sampling. The adaptive techniques we propose are enabled by efficient and sharp a posteriori error estimators. The error estimators not only guide the offline generation of reduced-order models, but also provide error certification for their online use. Our adaptive techniques cover linear steady, time-harmonic, dynamical systems and nonlinear dynamical systems. We demonstrate the advantages resulting from our approach on a range of numerical examples and finally chart out interesting avenues of future research.

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