Sample Selection Approaches in Parameterized Model Order Reduction

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Modeling of scientific or industrial applications often yields high-dimensional dynamical systems due to techniques of computer-aided-design, for example. Thus a model order reduction is required to decrease the dimensionality to enable an efficient numerical simulation. In addition, methods of parameterized model order reduction (pMOR) shall preserve the physical parameters as independent variables in the reduced order models. We consider linear dynamical systems in the form of ordinary differential equations. In the domain of the parameters, often samples are chosen to construct a reduced order model. For each sample point an ordinary technique for model order reduction can be applied to compute a local basis. Moment matching techniques or balanced truncation schemes are feasible, for example. A global basis for pMOR can be constructed from the local bases by a singular value decomposition. We investigate approaches for an appropriate selection of the finite set of samples. Our focus is on moment matching techniques using the Arnoldi procedure. Hence the transfer function of the dynamical system is examined in the frequency domain. We use a sensitivity analysis of the transfer function with respect to the parameters as a tool to select sample points. Simulation results are shown for illustrative examples.