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An Iterative Active Subspace Approach for Model Order Reduction of Parametric Systems with High-Dimensional Parameter Spaces

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The increasing complexity in design and manufacturing has driven the need for advanced techniques for fast modeling problems with high-dimensional parameter spaces. Avoiding high-fidelity finite element models while achieving fast and accurate simulations in such contexts is challenging. Projection-based parametric model order reduction (pMOR) has drawn significant attention in recent years. Nevertheless, the curse of dimensionality in parameter spaces has severely limited its effectiveness. The active subspace (AS) approach has been successfully applied to pMOR for systems with many parameters. However, the balance between accuracy and compactness of the reduced model remains problematic for systems with high-dimensional parameter spaces. It often results in models that are either small enough or accurate enough. We propose an iterative active subspace (IAS) approach for parametric model order reduction, which, to some extent, addresses the trade-off between accuracy and reduced model size and achieves substantial computational gains compared to the original active subspace method.

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