

Low-rank approximations and optimal model reduction of high-dimensional stochastic problems

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Tensor approximation methods are receiving a growing attention for their use in uncertainty quantification where functions of multiple random parameters have to be approximated.

Here, we present strategies for complexity reduction which are based on low-rank and sparse approximation methods. We discuss the connection between best approximation problems in low-rank tensor subsets and the problem of optimal model reduction in low-dimensional reduced spaces, and we present algorithms for the approximation of these reduced spaces. We finally present algorithms that are able to directly construct quasi-optimal low-rank approximations of the solution of equations in tensor format, where the optimality is associated to a desired metric. These algorithms, which apply to a rather large class of stochastic PDEs, are based on perturbations of ideal minimal residual formulations.