Randomized Model Order Reduction
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In this talk we show how randomization can be exploited both for constructing reduced order models and deriving a posteriori error estimators for the approximation error.

We propose local approximation spaces for localized model order reduction procedures such as domain decomposition and multiscale methods, where those spaces are constructed from local solutions of the partial differential equation (PDE) with random boundary conditions. Moreover, we construct reduced models for time-dependent problems by prescribing random initial conditions at random points in time. Extending methods and results from randomized linear algebra allows us to analyze the convergence rate of the randomized approximations.

In addition, we propose a randomized residual-based a posteriori error estimator for reduced order approximations for parametrized PDEs. Here, we address both the error between the reduced and the high-fidelity solution and, secondly, between the exact solution of the PDE and any approximation. This error estimator does not require to estimate any stability constants and its effectivity is close to unity with prescribed lower and upper bounds at specified high probability. To derive the estimator, we rely on results similar to the restricted isometry property employed in compressed sensing.

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