Optimization based model order reduction for stochastic systems

M. A. Freitag[1] and M. Redmann[2]

[1]*Institute for Mathematics, University of Potsdam, Campus Golm, 14476 Potsdam, Germany*
[2]*Institute for Mathematics, University of Halle-Wittenberg, 06099 Halle (Saale) Germany*

In this talk, we will connect ideas from model order reduction for stochastic linear systems and $\mathcal{H}_2$-optimal model order reduction for deterministic systems. In particular, we supplement and complete the theory of error bounds for model order reduction of stochastic differential equations. With these error bounds, we establish a link between the output error for stochastic systems (with additive and multiplicative noise) and modified versions of the $\mathcal{H}_2$-norm for both linear and bilinear deterministic systems. When deriving the respective optimality conditions for minimizing the error bounds, we will see that model order reduction techniques related to iterative rational Krylov algorithms (IRKA) are very natural and effective methods for reducing the dimension of large-scale stochastic systems with additive and/or multiplicative noise. We apply modified versions of (linear and bilinear) IRKA to stochastic linear systems and show their efficiency in numerical experiments.