Deep learning methods for stochastic Galerkin approximations of random elliptic PDEs

Fabio Musco
University of Stuttgart
fabio.musco@mathematik.uni-stuttgart.de

Coauthor(s): Andrea Barth

Special session: Efficient methods for uncertainty quantification in differential equations

We consider stochastic Galerkin approximations of linear elliptic partial differential equations with stochastic forcing terms and stochastic diffusion coefficients. A classical numerical solver for the resulting high-dimensional coupled system of PDEs is replaced by deep learning approaches. We compare different methods and discuss advantages and shortcomings, such as general applicability and mathematical rigor in the problem formulation. We demonstrate the efficiency of the approaches in various test cases including log-normal coefficients and stochastic right-hand sides. With our approach we are able to push the dimensionality of the coupled system into the hundreds.