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A numerical method for solving elliptic PDEs with coefficients perturbed by spatial white noise

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ABSTRACT

We consider numerical solutions of elliptic stochastic PDEs driven by spatial white noise. Our model is unbiased in that the expectation of the solution solves the same equation with statistically averaged coefficients. The developed numerical algorithms are based on finite element discretization in the physical space, and Wiener chaos expansion in the probability space. Since in many practically important examples solutions of the elliptic SPDEs have infinite variance, we investigate the convergence of our algorithms in appropriately weighted Wiener chaos spaces. The convergence is studied both theoretically and numerically. We compare the analytical and statistical properties of the current stochastic model with other models in the literature.