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Abstract

A few elements of numerical analysis for PDEs with random coefficients of lognormal type

In this talk, we will address some basic issues appearing in the theoretical analysis of numerical methods for PDEs with random coefficients of lognormal type. To begin with, such problems will be motivated by applications to the study of subsurface flow with uncertainty. We will then give some results concerning the spatial regularity of solutions of such problems, which of course impacts the error committed in spatial discretization. We will complete these results with integrability properties to deal with unboundedness of these solutions and then give error bounds for the finite element approximations in adequate norms. Then we will see how these two results enable, among other things, to provide a bound for the computationnal cost of the multi-level Monte Carlo algorithm. Finally we will discuss the question of the dimensionality, which is crucial for numerical methods such as stochastic collocation. We will consider the approximation of the random coefficient through a Karhunen-Loève expansion, and provide bounds of the resulting error on the solution by highlighting the interest of the notion of weak error.