Uncertainty Quantification in Stochastic Differential Equations

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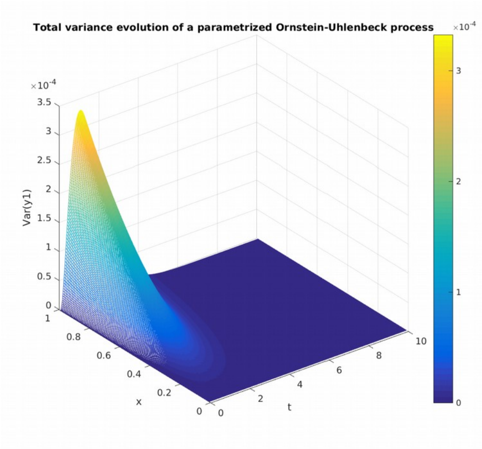
Concerning dynamical systems, uncertainty analysis for Partial Differential Equations (PDEs) has been the subject of several papers in the past years. The Monte Carlo (MC) method and the model reduction techniques are often used in this framework. Another recent paper addresses the topic of uncertainty analysis for Stochastic Differential Equations (SDEs). It points out that, using a proper Polynomial Chaos (PC) analysis of SDEs driven by Wiener noise, it is possible to identify the modes of the SDE that are the most relevant for uncertainty analysis.



In this work, we first consider the mean value relative to the intrinsic randomness as the quantity of interest for uncertainty analysis. We propose an alternative appoach, in which we firstly transform the problem from a parametrized SDE to a parametrized PDE, using the famous Feynman-Kac formulae, then we either use MC samplings for the PDE, or apply PC expansion for the solution of the PDE, combined with stochastic Galerkin technique. For further, we consider studying in particular the sensitivity of the output time from a bounded set of a diffusion with respect to various uncertain parameters.