# Numerical approximation of random PDEs: advances and challenges

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Partial differential equations with random coefficients and input data (random PDEs in short) arise in many applications in which the data of the PDE need be described in terms of random variables/fields due either to a lack of knowledge of the system or to its inherent non-predictability. Typical examples are the prediction of stresses on a structure under the action of random forces, such as wind and/or earthquakes, the forecasting of weather, or the design of groundwater management policies that take into account rainfall and the properties of the subsurface soil which are known only at a few drilling locations. The numerical approximation of statistics of the solution or quantities of interested related to it poses several challenges when the number of random parameters is large or infinite as in the case of distributed random fields.

In this talk we review sampling and collocation-type approaches based on the solution of the PDE for several random or well designed deterministic choices of parameters. Such collocation strategies can be optimally combined with hierarchical discretizations of the PDE to achieve optimal complexity. We discuss recent results on Monte Carlo and sparse grids stochastic collocation methods combined with hierarchical anisotropic discretizations of elliptic PDEs in a Multi-Level / Multi-Index framework and highlight open issues.