Kernel-based lattice point interpolation for UQ using periodic random variables

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Abstract

This talk describes a kernel-based approximation method based on lattice points, for the approximate solution of an elliptic PDE with an input random field described by periodic stochastic variables. The analysis (incorporating results obtained recently by Cools, Kuo, Nuyens and Sloan) shows that with well chosen lattice points the method can give the best possible rate of L_2 convergence for any method that uses lattice points, and a manageable error bound even if the stochastic dimension is high. The practical advantage of the method is that the lattice structure makes it simple and cheap to implement: the $N \times N$ kernel matrix is a circulant matrix, and so has only N different elements, while being easily inverted by Fast Fourier Transform; and the kernel is available in closed form even when the dimension d is large, and computable in a time of order d.