Wavelet representations for stochastic processes defined by multiple Wiener-Itô integrals

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Abstract

In this talk, we define the d-multiple Wiener-Itô integral $I_d(f)$ of a function $f \in L^2(\mathbb{R}^d)$ with respect to a Brownian motion $\{B(x)\}_{x\in\mathbb{R}}$ on a probability space $(\Omega, \mathcal{F}, \mathbb{P})$.

Then, we present a general strategy, based on wavelet analysis, to represent a stochastic process of the form $\{I_d(K(t,\bullet))\}_{t\geq 0}$, where, for all $t \geq 0$, the kernel function satisfies $K(t,\bullet) \in L^2(\mathbb{R}^d)$.

In particular, we apply this procedure to the (generalized) Hermite process and obtain an explicit almost sure rate of convergence of the obtained random series with respect to the uniform norm on compact sets.

We conclude by some words concerning a work in progress where this wavelet approximation is used to produce the first-ever numerical simulation of Hermite processes.

This talk is based on joint works with Antoine Ayache and Julien Hamonier from the University of Lille.