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Title:
Oscillatory fractional Brownian motion and related processes arising from particle systems

Abstract:
Oscillatory fractional Brownian motion with parameter $H \in (1/2, 1)$ is a centered Gaussian process $\xi = (\xi_t)_{t \geq 0}$ with covariance function

$$\text{Cov}(\xi_s, \xi_t) = \frac{1}{2} \left( s^{2H} h_s + t^{2H} h_t - |s - t|^{2H} h_{|s-t|} \right), \quad s, t \geq 0,$$

where

$$h_t = \sum_{j=-\infty}^{\infty} (ba^j t)^{-2H} (e^{-ba^j t} - 1 + ba^j t), \quad t > 0, \quad h_0 = 0,$$

constants $b > 0$ and $a \in (0, 1)$. The function $h$ is periodic in logarithmic scale (i.e., $h_t = h_{at}$, $t > 0$), and oscillates between two positive values, slower as $t \to \infty$ and faster as $t \to 0$. This process is an oscillatory analogue of fractional Brownian motion with Hurst parameter $H$ (which corresponds to $h \equiv 1$). A related process is an oscillatory analogue of sub-fractional Brownian motion.

In the talk we will show how these processes arise in occupation time fluctuation limits of systems of random walks on a hierarchical group. The oscillations are caused by the discrete and ultrametric structure of the group. Properties of these processes and comparisons with those of their non-oscillatory counterparts will be discussed.

(This is joint work with T. Bojdecki and A. Talarczyk, University of Warsaw).

Reference