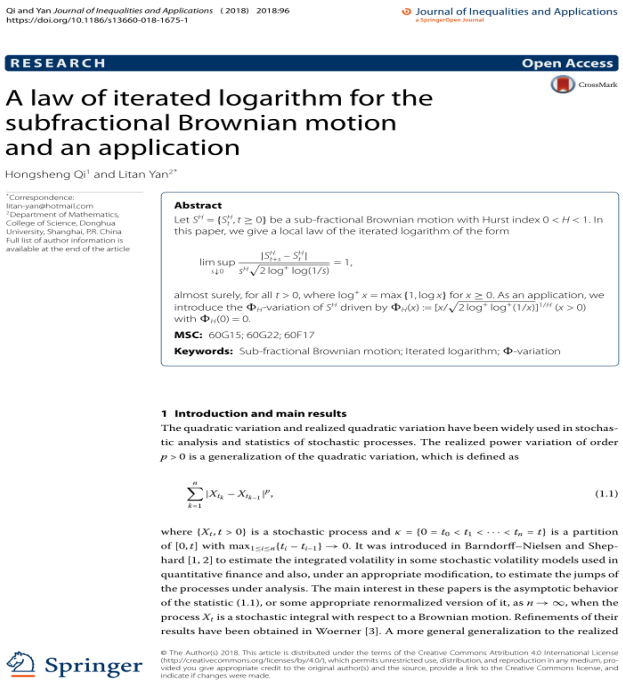
Integral Transformations And Anticipative Calculus For Fractional Brownian Motions



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A law of iterated logarithm for the subfractional Brownian motion and an application

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Abstract

Let $S^H = \{S_t^H, t \geq 0\}$ be a sub-fractional Brownian motion with Hurst index $0 < H < 1$. In this paper, we give a local law of the iterated logarithm of the form

$$\limsup_{s \downarrow 0} \frac{|S_{t+s}^H - S_t^H|}{s^H \sqrt{2 \log^+ \log(1/s)}} = 1,$$

almost surely, for all $t > 0$, where $\log^+ x = \max\{1, \log x\}$ for $x \geq 0$. As an application, we introduce the Φ_H-variation of S^H driven by $\Phi_H(x) := [x/\sqrt{2 \log^+ \log^+(1/x)}]^{1/H}$ $(x > 0)$ with $\Phi_H(0) = 0$.

MSC: 60G15; 60G22; 60F17

Keywords: Sub-fractional Brownian motion; Iterated logarithm; Φ-variation

1 Introduction and main results

The quadratic variation and realized quadratic variation have been widely used in stochastic analysis and statistics of stochastic processes. The realized power variation of order $p > 0$ is a generalization of the quadratic variation, which is defined as

$$\sum_{k=1}^{n} |X_{t_k} - X_{t_{k-1}}|^p, \tag{1.1}$$

where $\{X_t, t > 0\}$ is a stochastic process and $\kappa = \{0 = t_0 < t_1 < \cdots < t_n = t\}$ is a partition of $[0, t]$ with $\max_{1 \leq i \leq n}\{t_i - t_{i-1}\} \to 0$. It was introduced in Barndorff–Nielsen and Shephard [1, 2] to estimate the integrated volatility in some stochastic volatility models used in quantitative finance and also, under an appropriate modification, to estimate the jumps of the processes under analysis. The main interest in these papers is the asymptotic behavior of the statistic (1.1), or some appropriate renormalized version of it, as $n \to \infty$, when the process X_t is a stochastic integral with respect to a Brownian motion. Refinements of their results have been obtained in Woerner [3]. A more general generalization to the realized

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