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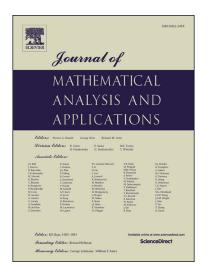
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## ACCEPTED MANUSCRIPT

## LARGE DEVIATIONS FOR SUBORDINATED FRACTIONAL BROWNIAN MOTION AND APPLICATIONS

#### WEIGANG WANG\*, ZHENLONG CHEN

ABSTRACT. Let  $W^H = \{W^H(t), t \in \mathbb{R}\}$  be a real valued fractional Brownian motion with Hurst index  $H \in (0, 1)$  and let  $T = \{T_t, t \ge 0\}$  be an inverse  $\alpha$ -stable subordinator independent of  $W^H$ . The inverse stable subordintor fractional Brownian motion  $Z^H = \{Z^H(t), t \ge 0\}$  is defined by  $Z^H(t) = W^H(T_t)$ , which may arise as scaling limit of CTRW or random walk in a random environment. In this paper we establish large deviation results for the process  $Z^H$  and its supremum process. And we also give asymptotic properties of the tail probability of the supremum process.

### 1. INTRODUCTION AND STATEMENT OF RESULTS

Fractional Brownian motion (fBm) is a centered Gaussian process  $W^H = \{W^H(t), t \in \mathbb{R}\}$  with  $W^H(0) = 0$  and covariance function

$$\mathbb{E}\left(W^{H}(s)W^{H}(t)\right) = \frac{1}{2}\left(|s|^{2H} + |t|^{2H} - |s - t|^{2H}\right),\$$

where  $H \in (0, 1)$  is a constant. It is known that  $W^H$  is self-similar with index H (i.e., for all constants c > 0, the processes  $\{W^H(ct), t \in \mathbb{R}\}$  and  $\{c^H W^H(t), t \in \mathbb{R}\}$  have the same finite-dimensional distributions) and has stationary increments. When H = 1/2,  $W^H$  is a two-sided Brownian motion, which will be written as W.

FBm is an improtant example of self-similar processes which arise naturally in limit theorems of random walks and other stochastic processes, and it has been applied to model various phenomena in a wide range of scientific ares including telecommunications, turbulence, image processing and finance.

In this paper, we consider a class of iterated self-similar processes which is related to continuoustime random walks considered in [3, 13]. Let  $X = \{X_t, t \ge 0\}$  be a real-valued  $\alpha$ -stable subordinator, where  $0 < \alpha < 1$ . We assume that X is independent of  $W^H$ ,  $T = \{T_t, t \ge 0\}$  be the inverse process of X, i.e  $T_t = \inf\{\tau; X_\tau > t\}$ . Let  $Z^H = \{Z^H(t), t \ge 0\}$  be the real-valued stochastic process defined by  $Z^H(t) = W^H(T_t)$  for all  $t \ge 0$ . This iterated process will be called subordinated fractional Brownian motion. When H = 1/2,  $Z^H(t)$  will be written as Z, which is also called fractional kinetic process [2, 12].

References [8, 11] proved the large deviations for subordinated fractional Brownian motion under the condition of  $2H(1-\alpha) < 1$ . In this paper, we will establish large deviations for the subordinated fractional Brownian motion  $Z^H$  and supremum  $\sup_{0 \le s \le t} Z^H(s)$  without the exact condition. And we also give asymptotic properties of the tail probability of the supremum process in Section 4. The following are our main results.

**Theorem 1.1.** Let  $Z^H = \{Z^H(t), t \ge 0\}$  be real-valued subordinated fractional Brownian motion. Then for every  $\beta > 0$  such that  $0 < \beta(\frac{1}{2} + H - \alpha H) < 1$ , every function a(t) with  $\lim_{t\to\infty} a(t) = \infty$ , and every Borel set  $D \subseteq \mathbb{R}$ ,

$$\limsup_{t \to \infty} \frac{1}{a(t)^{1/[1-\beta(\frac{1}{2}+H-\alpha H)]}} \log \mathbb{P}\left\{\frac{|Z^H(t)|^{\beta}}{a(t)^{\beta(\frac{1}{2}+H-\alpha H)/[1-\beta(\frac{1}{2}+H-\alpha H)]}t^{\alpha\beta H}} \in D\right\} \le -\inf_{x \in \bar{D}} \Lambda_1^*(x) \quad (1)$$

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