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Randomness And Fractional Stable Distributions

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ABSTRACT

Stochastic and fractional models are defined by applications of Liouville (and other) fractional operators. They underlie anomalous transport dynamical properties such as long range temporal correlations manifested in power laws. Prolific applications to finance and other domains have been published, based mostly on a randomness defined by the fractional Brownian Motion. Application to probability distributions (Tapiero and Vallois 2016a, 2017, 2018), have indicated that fractional distributions are incomplete and their limit distributions (based on the Central LimitTheorem) depend on their fractional index. For example, for a fractional index $1/2 \le H \le 1$, we showed that a fractional Brownian Bridge defines a fractional randomness (rather than a Brownian Motion). In this paper we consider the case $0 < H < 1/2$ and prove that the underlying fractional distribution is a randomness defined by an $\alpha -$ stable distribution with $\alpha = 1/(1-H)$ to $H \in]1,2[$. Then, the smaller the fractional index, the greater the propensity for a randomness to be defined by a jump process rather than diffusions defining randomness. These properties are important in applications where risks, prices and their management are dependent of their definition of randomness.