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Self-similar processs: stochastic and statistical analysis

Ciprian A. Tudor - *Université Lille 1*

Self-similar processes are stochastic processes that are invariant in distribution under suitable scal- ing of time and space. This property is crucial in applications such as network traffic analysis, mathematical finance, astrophysics, hydrology or image processing. For these reasons, their analysis constitutes an important research direction in probability theory since a while.
Our purpose is to discuss the basic properties of several classes of (Gaussian or non-Gaussian) self- similar stochastic processes. The main example is the fractional Brownian motion which the most known self- similar process with stationary increments. It includes the standard Brownian motion as a particular case. The applications of this process are now widely recognized. We survey the basic properties of the process and several other processes related with it that emerged recently in the scientific research.
On the other hand, the self-similar stochastic processes are well suited to model various phenomena where scaling and long memory are important factors (internet traffic, hydrology, econometrics, among other). The most important modeling task is then to determine or estimate the self- similarity parameter, because it is also typically responsible for the process?s long memory and its regularity properties. Studying them is thus an important research direction in theory and practice. Our purpose is to present recent results in this direction. The approach we use is based on the so-called Malliavin calculus and multiple Wiener-Ito integrals.

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