On Fluctuation with Memory and White Noise Analysis

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ABSTRACT

A fluctuating variable $x(\tau)$ with memory of the past may be modelled by parameterizing its evolution in time $t$ by,

$$x(\tau) = x_0 + \int_0^\tau f(\tau - t) \, h(t) \, \omega(t) \, dt.$$ 

Here $f(\tau - t)$ is a memory function, $h(t)$ a deterministic factor, and $\omega(t)$ a random white noise variable. The explicit form of $f(\tau - t)$ and $h(t)$ would depend on the natural or social phenomena being modelled. Application of white noise analysis [1, 2], which was originally introduced by T. Hida, facilitates the evaluation of the conditional probability density as a summation-over-all histories [3]. The corresponding diffusion equation and related standard deviation for various forms of $f(\tau - t)$ and $h(t)$ are discussed. The usual fractional Brownian motion appears as a special case. Possible applications of this approach are also given [4].

References


