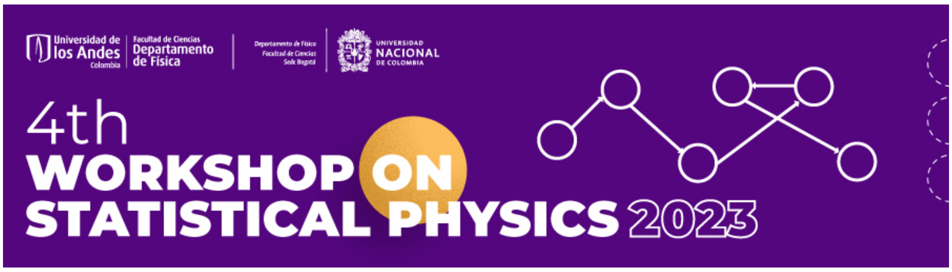

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Generalized fractional Feynman-Kac formula

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Most stochastic processes are solved by knowing the probability distribution of the process increments or the transition probability distribution that satisfies a Fokker-Planck equation. Also, a rather interesting and known application of stochastic processes is in the Feynman-Kac formula, which presents the equivalence of parabolic partial differential equation problems and stochastic processes under the Feynman path integral. Specifically, it has been shown that the Feynman-Kac formula is nothing more than the Fokker-Planck equation associated with the process but with "final" conditions instead of initial conditions. Then, we generalize the Feynman-Kac formula for an arbitrary additive stochastic process with a right-handed fractional Riemann-Liouville integral of order $H-1/\alpha+1$ with H the Hurst exponent. To this end, we start from the evolution equation of a fractional stable process of order $H-1/\alpha+1$ and its stochastic component is modified with an arbitrary noise $\eta(t)$ to obtain a fractional Langevin equation. Thence, making use of the path integral formalism, an expression is deduced for the transition probability between two states of the stochastic process in terms of the noise cumulant generating function denoted by $H(p)$. Furthermore, the entire formalism is held in terms of the It\^{o} and Stratonovich calculus by a parameter $\gamma\in[0,1]$. Next, the extension of the Feynman-Kac formula is made for the fractional Langevin equation by deriving the Fokker-Planck equation of the underlying stochastic process in terms of the cumulant generating function. Additionaly, the Feynman-Kac formula is deduced in the particular case of a truncated Lévy distribution.

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