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Abstract

The purpose of this paper is to develop a fractional white noise calculus and to apply this to markets modeled by (Wick-) Itô type of stochastic differential equations driven by fractional Brownian motion $B_H(t)$; $1/2 < H < 1$.

We show that if we use an Itô type of stochastic integration with respect to $B_H(t)$ (as developed in Ref. 8), then the corresponding *Itô fractional Black-Scholes market has no arbitrage*, contrary to the situation when the pathwise integration is used. Moreover, we prove that our Itô fractional Black-Scholes market is complete and we compute explicitly the price and replicating portfolio of a European option in this market. The results are compared to the classical results based on standard Brownian motion $B(t)$.

Keywords: Fractional Brownian motions ▪ fractional white noises ▪ chaos expansion ▪ Wick calculus ▪ Fractal Black-Scholes market ▪ arbitrage ▪ price formula ▪ replicating portfolio

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