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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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