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Change of Time Method in Mathematical Finance

In this talk, we show how the change-of-time method works for different kind of models and problems arising in financial mathematics. We study the following three models in mathematical finance: geometrical Brownian motion model for stock price, mean-reverting model for commodity asset price and stochastic volatility model (that follows Cox–Ingersoll–Ross process) for Heston model of stock price. We apply the change-of-time method to derive (yet one more) the well-known Black–Scholes formula for European call option and to derive the explicit option pricing formula for European call option on mean-reverting model of commodity asset. We also derive the explicit formulas for variance and volatility swaps for financial markets with stochastic volatility following Cox–Ingersoll–Ross (1985) process (Heston (1993) model of stock price). Two numerical examples on the S&P60 Canada Index (January 1997–February 2002) to price variance and volatility swaps for Heston model and on AECO Natural Gas Index (1 May 1998–30 April 1999) to price European call option for mean-reverting asset model will be presented.