General Asymptotics of Wiener Functionals and Application to Mathematical Finance

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Abstract

In the presentation, we give an asymptotic expansion of probability density for a component of general diffusion models. Our approach is based on infinite dimensional analysis on the Malliavin calculus and Kusuoka-Stroock’s asymptotic expansion theory for general Wiener functionals [2]. The initial term of the expansion is given by the ‘energy of path’ and we calculate the energy by solving Hamilton equation.

There are many applications of asymptotic expansion theory to mathematical finance. Most popular application is the singular perturbation approach. For example, Hagan-Kumar-Lesniewski-Woodward [1] gave a formula of implied volatilities for a stochastic volatility model named SABR model. Their formula is well-known for practitioners. We apply our approach to this problem and obtain general asymptotic expansion formulae of implied volatilities for general diffusion models.

References


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