On Spherical Monte Carlo Simulation with Applications in Option Pricing under GARCH Models

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Abstract

For high-dimensional integrals calculation, Monte Carlo method is a indispensable tool, but is also known for its low convergence. This paper proposes a tilted spherical Monte Carlo estimator that utilizes the spherical transformation for spherical distributions and depends on a predetermined set of points on the unit sphere constructed via the lattice D_d. Substantial improvements of the proposed scheme in terms of variance reduction and computational time are demonstrated via pricing exotic options under GARCH models.

Keywords: spherical transformation, Monte Carlo method, high-dimensional, integrals, financial derivatives pricing, lattice, random orthogonal matrix.