Precise option pricing by the COS method – how to choose the truncation range.

Summary: The Fourier cosine expansion (COS) method is used for pricing European options numerically very fast. To apply the COS method, a truncation range for the density of the log-returns need to be provided. Using Markov’s inequality, we derive a new formula to obtain the truncation range and prove that the range is large enough to ensure convergence of the COS method within a predefined error tolerance. We also show by several examples that the classical approach to determine the truncation range by cumulants may lead to serious mispricing. Usually, the computational time of the COS method is of similar magnitude in both cases.

MSC:
65T40 Numerical methods for trigonometric approximation and interpolation
42A10 Trigonometric approximation
60E10 Characteristic functions; other transforms
91G20 Derivative securities (option pricing, hedging, etc.)

Keywords:
COS method; cosine expansion; option pricing; truncation range; Markov’s inequality

Full Text: DOI

References: