Numerical Evaluation of Complex Logarithms in the Cox-Ingersoll-Ross Model

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Abstract

The Cox-Ingersoll-Ross model (CIR model) \[2\] has been a benchmark in finance for many years because of its analytical and structural tractability. The wide applications and extensions of the CIR model requires to evaluate the cumulative distribution function (CDF) of the integrated CIR process in financial modelling. As in many situations the characteristic function of the integrated CIR process is already known analytically, we can use the method of option pricing by Carr and Madan \[1\] to transform it to the corresponding CDF.

This characteristic function is defined via complex logarithms and ought to be integrated using the inverse Fourier transform, so that numerical instabilities may appear. Especially, the instability is expected to increase with some levels of model parameters. In this work, we adapt the recent approach by Kahl and Jäckel \[3\] to deal with such instability problems. This strategy allows to have a robust and numerically accurate CDF of the integrated CIR process for almost any ranges of parameters.

References

