Exact simulation of NTS processes of OU type with applications

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Abstract

In this study we characterized the Ornstein-Uhlenbeck process having a symmetric normal tempered stable stationary law extending accordingly, the findings in Barndolff-Nielsen [1]. To this end, we represent the transition distribution in terms of the sum of independent laws and also write its relative background driving Lévy process in terms of the sum of two independent Lévy processes. Based on these facts we can design two alternate algorithms for the simulation of the skeleton of the Ornstein-Uhlenbeck process. The solution based on the transition law turns out to be faster since it is based on a lower number of computational steps; that is also confirmed by extensive numerical experiments. We also calculate the characteristic function of the transition density which is instrumental for the application of the FFT-based method of Carr and Madan [2] to the pricing of a strip of call options written on markets whose price evolution is modeled by an Ornstein-Uhlenbeck dynamics. This approach is indeed common for spot prices in the energy and the commodity fields. Finally, we show how to extend the range of applications to future markets.

References

[1] O.E. Barndorff-Nielsen. Processes of Normal Inverse Gaussian Type. *Finance and Stochastics*, 2(1):41–68, 1998.

[2] P. Carr and D.B. Madan. Option Valuation Using the Fast Fourier Transform. *Journal of Computational Finance*, 2:61–73, 1999.

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