

Spectral domain decomposition methods for efficient valuations of partial integral differential equations in finance

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Abstract

Spectral methods have been actively developed in the last decades. The main advantage of these methods is that they yield exponential order accuracy if the function is smooth enough. However, for discontinuous functions, their accuracy deteriorates to low accuracy due to the Gibbs phenomenon. This explains why their application of spectral methods to numerically solve PDEs and PIDEs in finance is seldom. However, high order convergence can be recovered from spectral approximation contaminated with the Gibbs phenomenon if proper workarounds are applied.

We propose a spectral domain decomposition method to efficiently restore the high accuracy of spectral methods in valuing financial options. The application of spectral methods to the PIDE leads to a system of ordinary differential equations which is exactly solved using exponential time differencing methods. Numerical experiments illustrate that our approach is highly accurate and efficient for pricing financial options.