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A Numerical Method for Pricing Discrete Double Barrier Option by Legendre Multiwavelete

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Abstract

In this Article, a fast numerical numerical algorithm for pricing discrete double barrier option is presented. According to Black-Scholes model, the price of option in each monitoring date can be evaluated by a recursive formula upon the heat equation solution. These recursive solutions are approximated by using Legendre multiwavelets as orthonormal basis functions and expressed in operational matrix form. The most important feature of this method is that its CPU time is nearly invariant when monitoring dates increase. Besides, the rate of convergence of presented algorithm was obtained. The numerical results verify the validity and efficiency of the numerical method.

Keywords: Double and single barrier options, BlackScholes model, Option pricing, Legendre Multiwavelete
2010 MSC: 65D15, 35E15, 46A32

1. Introduction

Barrier options play a key role in the price risk management of financial markets. There are two types of barrier options: single and double. In single case we have one barrier but in double case there are two barriers. A barrier option is called knock-out (knock-in) if it is deactivated (activated) when the stock price touches one of the barriers. If the hitting of barriers by the stock price is checked in fixed dates, for example weakly or monthly, the barrier option is called discrete.

Option pricing as one of the most interesting topics in the mathematical finance has been investigated vastly in the literature. Kamrad and Ritchken [1], Boyle and Lau [2], Kwok [3], Heyen and Kat [4], Tian [5] and Dai and Lyuu [6] used standard lattice techniques, the binomial and trinomial trees, for pricing barrier options. Ahn et al. [7] introduce the adaptive mesh model (AMM)

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