Pseudo-Differential Operators
Theory and Applications
12

Andrey Itkin

Pricing Derivatives Under Lévy Models

Modern Finite-Difference and Pseudo-Differential Operators Approach

Birkhäuser

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Modern Finite-Difference and Pseudo-Differential Operators Approach

Series: Pseudo-Differential Operators

- Introduction of a modern finite-difference approach
- Presents few new results on FD schemes for PDEs, including schemes which preserve positivity
- Gives the reader a detailed description of the new method, including the whole theory and real practical examples so it can be immediately used for building reader's own applications

This monograph presents a novel numerical approach to solving partial integro-differential equations arising in asset pricing models with jumps, which greatly exceeds the efficiency of existing approaches. The method, based on pseudo-differential operators and several original contributions to the theory of finite-difference schemes, is new as applied to the Lévy processes in finance, and is herein presented for the first time in a single volume. The results within, developed in a series of research papers, are collected and arranged together with the necessary background material from Lévy processes, the modern theory of finite-difference schemes, the theory of M-matrices and EM-matrices, etc., thus forming a self-contained work that gives the reader a smooth introduction to the subject. For readers with no knowledge of finance, a short explanation of the main financial terms and notions used in the book is given in the glossary. The latter part of the book demonstrates the efficacy of the method by solving some typical problems encountered in computational finance, including structural default models with jumps, and local stochastic volatility models with stochastic interest rates and jumps. The author also adds extra complexity to the traditional statements of these problems by taking into account jumps in each stochastic component while all jumps are fully correlated, and shows how this setting can be efficiently addressed within the framework of the new method. Written for non-mathematicians, this book will appeal to financial engineers and analysts, econophysicists, and researchers in applied numerical analysis. It can also be used as anadvance course on modern finite-difference methods or computational finance.

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