Computational Methods For Option Pricing Frontiers In Applied Mathematics

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GILLIAN ROBERSON

Option Pricing Using Monte Carlo Methods Cambridge University Press

Computational Methods for Option PricingSIAM

A Partial Differential Equation (PDE/FDM) Approach John Wiley & Sons

Abstract: This project is devoted primarily to the use of Monte Carlo methods to simulate stock prices in order to price European call options using control variates, and to the use of the binominal model to price American put options. At the end, we can use the information to form a portfolio position using an Interactive Brokers paper trading account. This project was done as a part of the masters capstone course Math 573: Computational Methods of Financial Mathematics.

Computational Methods in Finance Springer Science & Business Media

The disciplines of financial engineering and numerical computation differ greatly, however computational methods are used in a number of ways across the field of finance. It is the aim of this book to explain how such methods work in financial engineering; specifically the use of numerical methods as tools for computational finance. By concentrating on the field of option pricing, a core task of financial engineering and risk analysis, this book explores a wide range of computational tools in a coherent and focused manner and will be of use to the entire field of computational finance. Starting with an introductory chapter that presents the financial and stochastic background, the remainder of the book goes on to detail computational methods using both stochastic and deterministic approaches. Now in its fifth edition, Tools for Computational Finance has been significantly revised and contains: A new chapter on incomplete markets which links to new appendices on Viscosity solutions and the Dupire equation; Several new parts throughout the book such as that on the calculation of sensitivities (Sect. 3.7) and the introduction of penalty methods and their application to a two-factor model (Sect. 6.7) Additional material in the field of analytical methods including Kim's integral representation and its computation Guidelines for comparing algorithms and judging their efficiency An extended chapter on finite elements that now includes a discussion of two-asset options Additional exercises, figures and references Written from the perspective of an applied mathematician, methods are introduced as tools within the book for immediate and straightforward application. A 'learning by calculating' approach is adopted throughout this book enabling readers to explore several areas of the financial world. Interdisciplinary in nature, this book will appeal to advanced undergraduate students in mathematics, engineering and other scientific disciplines as well as professionals in financial engineering.

Computational Finance John Wiley & Sons

Many mathematical assumptions on which classical derivative pricing methods are based have come under scrutiny in recent years. The present volume offers an introduction to deterministic algorithms for the fast and accurate pricing of derivative contracts in modern finance. This unified, non-Monte-Carlo computational pricing methodology is capable of handling rather general classes of stochastic market models with jumps, including, in particular, all currently used Lévy and stochastic volatility models. It allows us e.g. to quantify model risk in computed prices on plain vanilla, as well as on various types of exotic contracts. The algorithms are developed in classical Black-Scholes markets, and then extended to market models based on multiscale stochastic volatility, to Lévy, additive and certain classes of Feller processes. This book is intended for graduate students and researchers, as well as for practitioners in the fields of quantitative finance and applied and computational mathematics with a solid background in mathematics, statistics or economics.

Tools for Computational Finance Springer Science & Business Media

This book constitutes revised and selected papers of the First International Conference on Computational Sciences - Modelling, Computing and Soft Computing, held in Kozhikode, Kerala, India, in September 2020. The 15 full papers and 6 short papers presented were thoroughly reviewed and selected from the 150 submissions. They are organized in the topical secions on computing; soft computing; general computing; modelling.

Numerical Methods in Computational Finance Springer Science & Business Media

Abstract: This paper aims to use Monte Carlo methods to price American call options on equities using the variance reduction technique of control variates and to price American put options using the binomial model. We use this information to form option positions. This project was done a part of the masters capstone course Math 573: Computational Methods of Financial Mathematics.

Tools for Computational Finance SIAM

This book contains mostly the author's up-to-date research results in the area. Option pricing has attracted much attention in the past decade from applied mathematicians, statisticians, practitioners and educators. Many partial differential equation-based theoretical models have been developed for valuing

various options. These models do not have any practical use unless their solutions can be found. However, most of these models are far too complex to solve analytically and numerical approximations have to be sought in practice. The contents of the book consist of three parts: (i) basic theory of stochastic control and formulation of various option pricing models, (ii) design of finite volume, finite difference and penalty-based algorithms for solving the models and (iii) stability and convergence analysis of the algorithms. It also contains extensive numerical experiments demonstrating how these algorithms perform for practical problems. The theoretical and numerical results demonstrate these algorithms provide efficient, accurate and easy-to-implement numerical tools for financial engineers to price options. This book is appealing to researchers in financial engineering, optimal control and operations research. Financial engineers and practitioners will also find the book helpful in practice.

Handbooks in Operations Research and Management Science: Financial Engineering Springer Science & Business Media

This book offers an introduction to the mathematical, probabilistic and numerical methods used in the modern theory of option pricing. The text is designed for readers with a basic mathematical background. The first part contains a presentation of the arbitrage theory in discrete time. In the second part, the theories of stochastic calculus and parabolic PDEs are developed in detail and the classical arbitrage theory is analyzed in a Markovian setting by means of of PDEs techniques. After the martingale representation theorems and the Girsanov theory have been presented, arbitrage pricing is revisited in the martingale theory optics. General tools from PDE and martingale theories are also used in the analysis of volatility modeling. The book also contains an Introduction to Lévy processes and Malliavin calculus. The last part is devoted to the description of the numerical methods used in option pricing: Monte Carlo, binomial trees, finite differences and Fourier transform.

Handbook of Computational and Numerical Methods in Finance Springer Science & Business Media

Mathematical finance is a prolific scientific domain in which there exists a particular characteristic of developing both advanced theories and practical techniques simultaneously. Mathematical Modelling and Numerical Methods in Finance addresses the three most important aspects in the field: mathematical models, computational methods, and applications, and provides a solid overview of major new ideas and results in the three domains. Coverage of all aspects of quantitative finance including models, computational methods and applications Provides an overview of new ideas and results Contributors are leaders of the field

Options Pricing Through Computational Methods Cambridge University Press

Although there are several publications on similar subjects, this book mainly focuses on pricing of options and bridges the gap between Mathematical Finance and Numerical Methodologies. The author collects the key contributions of several monographs and selected literature, values and displays their importance, and composes them here to create a work which has its own characteristics in content and style.This invaluable book provides working Matlab codes not only to implement the algorithms presented in the text, but also to help readers code their own pricing algorithms in their preferred programming languages. Availability of the codes under an Internet site is also offered by the author.Not only does this book serve as a textbook in related undergraduate or graduate courses, but it can also be used by those who wish to implement or learn pricing algorithms by themselves. The basic methods of option pricing are presented in a self-contained and unified manner, and will hopefully help readers improve their mathematical and computational backgrounds for more advanced topics.Errata(s)Errata

First International Conference, CSMCS 2020, Kozhikode, Kerala, India, September 10-12, 2020, Revised Selected Papers Elsevier

The subject of numerical methods in finance has recently emerged as a new discipline at the intersection of probability theory, finance, and numerical analysis. The methods employed bridge the gap between financial theory and computational practice, and provide solutions for complex problems that are difficult to solve by traditional analytical methods. Although numerical methods in finance have been studied intensively in recent years, many theoretical and practical financial aspects have yet to be explored. This volume presents current research and survey articles focusing on various numerical methods in finance. The book is designed for the academic community and will also serve professional investors.

Programming Techniques for High-performance Graphics and General-purpose Computation Elsevier

Abstract: This paper aims to practice the use of Monte Carlo methods to simulate stock prices in order to price European call options using control variates. American put options are priced using the binomial model separately. Finally, we use the information to form a portfolio position using an Interactive Brokers paper trading account.

The Fitted Finite Volume and Power Penalty Methods for Option Pricing Springer Science & Business Media

The Monte Carlo approach has proved to be a valuable and flexible computational tool in modern finance. A number of Monte Carlo simulation-based methods have been developed within the past years to address the American option pricing problem. The aim of this book is to present and analyze three famous simulation algorithms for pricing American style derivatives: the stochastic tree; the stochastic mesh and the least squares method (LSM). The author first presents the mathematical descriptions underlying these numerical methods. Then the selected algorithms are tested on a common set of problems in order to assess the strengths and weaknesses of each approach as a function of the problem characteristics. The results are compared and discussed on the basis of estimates precision and computation time. Overall the simulation framework seems to work considerably well in valuing American style derivative securities. When multi-dimensional problems are considered, simulation based methods seem to be the best solution to estimate prices since the general numerical procedures of finite difference and binomial trees become impractical in these specific situations.

Computational Methods for Option Pricing CRC Press

The remarkable growth of financial markets over the past decades has been accompanied by an equally remarkable explosion in financial engineering, the interdisciplinary field focusing on applications of mathematical and statistical modeling and computational technology to problems in the financial services industry. The goals of financial engineering research are to develop empirically realistic stochastic models describing dynamics of financial risk variables, such as asset prices, foreign exchange rates, and interest rates, and to develop analytical, computational and statistical methods and tools to implement the

models and employ them to design and evaluate financial products and processes to manage risk and to meet financial goals. This handbook describes the latest developments in this rapidly evolving field in the areas of modeling and pricing financial derivatives, building models of interest rates and credit risk, pricing and hedging in incomplete markets, risk management, and portfolio optimization. Leading researchers in each of these areas provide their perspective on the state of the art in terms of analysis, computation, and practical relevance. The authors describe essential results to date, fundamental methods and tools, as well as new views of the existing literature, opportunities, and challenges for future research.

Finite Element Methods for Derivative Pricing LAP Lambert Academic Publishing

Accompanying CD-ROM contains ... "working computer code, demonstration applications, and also PDF versions of several research articles that are referred to in the book." -- d.j.

The Numerical Solution of the American Option Pricing Problem World Scientific

More useful techniques, tips, and tricks for harnessing the power of the new generation of powerful GPUs.

Computational Methods for Quantitative Finance World Scientific Publishing Company

As today’s financial products have become more complex, quantitative analysts, financial engineers, and others in the financial industry now require robust techniques for numerical analysis. Covering advanced quantitative techniques, Computational Methods in Finance explains how to solve complex functional equations through numerical methods. The first part of the book describes pricing methods for numerous derivatives under a variety of models. The book reviews common processes for modeling assets in different markets. It then examines many computational approaches for pricing derivatives. These include transform techniques, such as the fast Fourier transform, the fractional fast Fourier transform, the Fourier-cosine method, and saddlepoint method; the finite difference method for solving PDEs in the diffusion framework and PIDEs in the pure jump framework; and Monte Carlo simulation. The next part focuses on essential steps in real-world derivative pricing. The author discusses how to calibrate model parameters so that model prices are compatible with market prices. He also covers various filtering techniques and their implementations and gives examples of filtering and parameter estimation. Developed from the author’s courses at Columbia University and the Courant Institute of New York University, this self-contained text is designed for graduate students in financial engineering and mathematical finance as well as practitioners in the financial industry. It will help readers accurately price a vast array of derivatives.

Novel Methods in Computational Finance Springer Science & Business Media

Computational finance is an interdisciplinary field which joins financial mathematics, stochastics, numerics and scientific computing. Its task is to estimate as accurately and efficiently as possible the risks that financial instruments generate. This volume consists of a series of cutting-edge surveys of recent developments in the field written by leading international experts. These make the subject accessible to a wide readership in academia and financial businesses. The book consists of 13 chapters divided into 3 parts: foundations, algorithms and applications. Besides surveys of existing results, the book contains many new previously unpublished results.

Monte Carlo Methods for American Option Pricing Springer

This book discusses the state-of-the-art and open problems in computational finance. It presents a collection of research outcomes and reviews of the work from the STRIKE project, an FP7 Marie Curie Initial Training Network (ITN) project in which academic partners trained early-stage researchers in close cooperation with a broader range of associated partners, including from the private sector. The aim of the project was to arrive at a deeper understanding of complex (mostly nonlinear) financial models and to develop effective and robust numerical schemes for solving linear and nonlinear problems arising from the mathematical theory of pricing financial derivatives and related financial products. This was accomplished by means of financial modelling, mathematical analysis and numerical simulations, optimal control techniques and validation of models. In recent years the computational complexity of mathematical models employed in financial mathematics has witnessed tremendous growth. Advanced numerical techniques are now essential to the majority of present-day applications in the financial industry. Special attention is devoted to a uniform methodology for both testing the latest achievements and simultaneously educating young PhD students. Most of the mathematical codes are linked into a novel computational finance toolbox, which is provided in MATLAB and PYTHON with an open access license. The book offers a valuable guide for researchers in computational finance and related areas, e.g. energy markets, with an interest in industrial mathematics.

An Introduction to Financial Option Valuation Academic Press

Any financial asset that is openly traded has a market price. Except for extreme market conditions, market price may be more or less than a “fair” value. Fair value is likely to be some complicated function of the current intrinsic value of tangible or intangible assets underlying the claim and our assessment of the characteristics of the underlying assets with respect to the expected rate of growth, future dividends, volatility, and other relevant market factors. Some of these factors that affect the price can be measured at the time of a transaction with reasonably high accuracy. Most factors, however, relate to expectations about the future and to subjective issues, such as current management, corporate policies and market environment, that could affect the future financial performance of the underlying assets. Models are thus needed to describe the stochastic factors and environment, and their implementations inevitably require computational finance tools.