Computational Methods For Option Pricing Frontiers In Applied Mathematics

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Topics in Numerical Methods for Finance Butterworth-Heinemann This book is a detailed and step-by-step introduction to the mathematical foundations of ordinary and partial differential equations, their approximation by the finite difference method and applications to computational finance. The book is structured so that it can be read by beginners, novices and expert users. Part A Mathematical Foundation for One-Factor Problems Chapters 1 to 7 introduce the mathematical and numerical analysis concepts that are needed to understand the finite difference method and its application to computational finance. Part B Mathematical Foundation for Two-Factor Problems Chapters 8 to 13 discuss a number of rigorous mathematical techniques relating to elliptic and parabolic partial differential equations in two space variables. In particular, we develop strategies to preprocess and modify a PDE before we approximate it by the finite difference method, thus avoiding ad-hoc and heuristic tricks. Part C The Foundations of the Finite Difference Method (FDM) Chapters 14 to 17 introduce the mathematical background to the finite difference method for initial boundary value problems for parabolic PDEs. It encapsulates all the background information to construct stable and accurate finite difference schemes. Part D Advanced Finite Difference Schemes for Two-Factor Problems Chapters 18 to 22 introduce a number of modern finite difference methods to approximate the solution of two factor partial differential equations. This is the only book we know of that discusses these methods in any detail. Part E Test Cases in Computational Finance Chapters 23 to 26 are concerned with applications based on previous chapters. We discuss finite difference schemes for a wide range of one-factor and two-factor problems. This book is suitable as an entry-level introduction as well as a detailed treatment of modern methods as used by industry quants and

MSc/MFE students in finance. The topics have applications to numerical analysis, science and engineering. More on computational finance and the author’s online courses, see www.datasim.nl.

Tools for Computational Finance CRC Press

This is a lively textbook providing a solid introduction to financial option valuation for undergraduate students armed with a working knowledge of a first year calculus. Written in a series of short chapters, its self-contained treatment gives equal weight to applied mathematics, stochastics and computational algorithms. No prior background in probability, statistics or numerical analysis is required. Detailed derivations of both the basic asset price model and the Black–Scholes equation are provided along with a presentation of appropriate computational techniques including binomial, finite differences and in particular, variance reduction techniques for the Monte Carlo method. Each chapter comes complete with accompanying stand-alone MATLAB code listing to illustrate a key idea. Furthermore, the author has made heavy use of figures and examples, and has included computations based on real stock market data.

First International Conference, CSMCS 2020, Kozhikode, Kerala, India, September 10-12, 2020, Revised Selected Papers John Wiley & Sons

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.

Special Volume CRC Press

Presenting state-of-the-art methods in the area, the book begins with a presentation of weak discrete time approximations of jump-diffusion stochastic differential equations for derivatives pricing and risk measurement. Using a moving least squares reconstruction, a numerical approach is then developed that allows for the construction of arbitrage-free surfaces. Free boundary problems are considered next, with particular focus on stochastic impulse control problems that arise when the cost of control includes a fixed cost, common in financial applications. The text proceeds with the development of a fear index based on equity option surfaces, allowing for the measurement of overall fear levels in the market. The problem of American option pricing is considered next, applying simulation methods combined with regression techniques and discussing convergence properties. Changing focus to integral transform methods, a variety of option pricing problems are considered. The COS method is practically applied for the pricing of options under uncertain volatility, a method developed by the authors that relies on the dynamic programming principle and Fourier cosine series expansions. Efficient approximation methods are next developed for the application of the fast Fourier transform for option pricing under multifactor affine models with stochastic volatility and jumps. Following this, fast and accurate pricing techniques are showcased for the pricing of credit derivative contracts with discrete monitoring based on the Wiener-Hopf factorisation. With an energy theme, a recombining pentanomial lattice is developed for the pricing of gas swing contracts under regime switching dynamics. The book concludes with a linear and nonlinear review of the arbitrage-free parity theory for the CDS and bond markets.

Tools for Computational Finance Academic Press

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.

Bordeaux, June 2010 Computational Methods for Option Pricing

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.

Computational Methods in Financial Engineering Springer Science & Business Media

Numerical Methods in Finance describes a wide variety of numerical methods used in financial analysis.

Option Pricing Using MATLAB. Springer Science & Business Media

This book presents a cogent description of the main methodologies used in derivatives pricing. Starting with a summary of the elements of Stochastic Calculus, Quantitative Methods in Derivatives Pricing develops the fundamental tools of financial engineering, such as scenario generation, simulation for

European instruments, simulation for American instruments, and finite differences in an intuitive and practical manner, with an abundance of practical examples and case studies. Intended primarily as an introductory graduate textbook in computational finance, this book will also serve as a reference for practitioners seeking basic information on alternative pricing methodologies. Domingo Tavella is President of Octanti Associates, a consulting firm in risk management and financial systems design. He is the founder and chief editor of the Journal of Computational Finance and has pioneered the application of advanced numerical techniques in pricing and risk analysis in the financial and insurance industries. Tavella coauthored Pricing Financial Instruments: The Finite Difference Method. He holds a PhD in aeronautical engineering from Stanford University and an MBA in finance from the University of California at Berkeley.
An Introduction to Financial Option Valuation Springer
Computational models and methods are central to the analysis of economic and financial decisions. Simulation and optimisation are widely used as tools of analysis, modelling and testing. The focus of this book is the development of computational methods and analytical models in financial engineering that rely on computation. The book contains eighteen chapters written by leading researchers in the area on portfolio optimization and option pricing; estimation and classification; banking; risk and macroeconomic modelling. It explores and brings together current research tools and will be of interest to researchers, analysts and practitioners in policy and investment decisions in economics and finance.
Handbook of Computational Finance SIAM
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.
Programming Techniques for High-performance Graphics and General-purpose Computation World Scientific Publishing Company
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
Numerical Methods for Pricing Financial Instruments Elsevier
This book allows you to understand fully the modern tools of numerical analysis in finance.
Handbooks in Operations Research and Management Science: Financial Engineering 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 Sciences - Modelling, Computing and Soft Computing Springer Nature
From the unique perspective of partial differential equations (PDE), this self-contained book presents a systematic, advanced introduction to the Black-Scholes-Merton's option pricing theory.A unified approach is used to model various types of option pricing as PDE problems, to derive pricing formulas as their solutions, and to design efficient algorithms from the numerical calculation of PDEs. In particular, the qualitative and quantitative analysis of American option pricing is treated based on free boundary problems, and the implied volatility as an inverse problem is solved in the optimal control framework of parabolic equations.
Finite Difference and Transform Approaches Springer Science & Business Media
The purpose of this paper is to show the practical application of computational methods to price options. Emphasis is especially given to the use of the Longstaff-Schwartz method for pricing American and exotic options. An implementation of these pricing methods in a computer program are demonstrated. The advantages of using object-oriented programming design patterns to make pricing programs more flexible and useful is also discussed.
Computational Methods for Quantitative Finance World Scientific
Latest Edition: Pricing Derivative Securities (2nd Edition)The development of successful techniques for valuing derivative assets is among the most influential achievements of economic science. Pricing Derivative Securities presents the theory of financial derivatives in a way that emphasizes both its mathematical foundations and its practical implementation. The book's organization reveals its three distinctive features. Part I surveys the necessary tools of analysis, probability theory, and stochastic calculus, thus making the book self-contained. The chapters in Part II, Pricing Theory, are organized around the dynamics of the price processes of underlying assets, progressing from simple models to those that require considerable mathematical sophistication. The last part of the book is devoted to the empirical implementation of the pricing formulas developed in Part II, offering a detailed survey of numerical methods and providing a collection of programs in FORTRAN and

C++.Errata(s)Preface, Page viChapter 13, Page 534?www.worldscientific.com/books/4415.zip? The above links should be replaced with?www.worldscientific.com/doi/suppl/10.1142/4415/suppl_file/4415_software_free.zip?Errata

GPU Gems 2 Springer Science & Business Media

Numerical methods in finance have emerged as a vital field at the crossroads of probability theory, finance and numerical analysis. Based on presentations given at the workshop Numerical Methods in Finance held at the INRIA Bordeaux (France) on June 1-2, 2010, this book provides an overview of the major new advances in the numerical treatment of instruments with American exercises. Naturally it covers the most recent research on the mathematical theory and the practical applications of optimal stopping problems as they relate to financial applications. By extension, it also provides an original treatment of Monte Carlo methods for the recursive computation of conditional expectations and solutions of BSDEs and generalized multiple optimal stopping problems and their applications to the valuation of energy derivatives and assets. The articles were carefully written in a pedagogical style and a reasonably self-contained manner. The book is geared toward quantitative analysts, probabilists, and applied mathematicians interested in financial applications.

Handbook of Computational and Numerical Methods in Finance Springer Nature

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

Finite Element Methods for Derivative Pricing Cambridge University Press

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.

Computational Finance John Wiley & Sons

Computational and numerical 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. 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 anyone working in computational finance. Starting with an introductory chapter that presents the financial and stochastic background, the book goes on to detail computational methods using both stochastic and deterministic approaches. Now in its sixth edition, Tools for Computational Finance has been significantly revised and contains: Several new parts such as a section on extended applications of tree methods, including multidimensional trees, trinomial trees, and the handling of dividends; Additional material in the field of generating normal variates with acceptance-rejection methods, and on Monte Carlo methods; 115 exercises, and more than 100 figures, many in color. Written from the perspective of an applied mathematician, all methods are introduced 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 and graduate students in mathematics, engineering, and other scientific disciplines as well as professionals in financial engineering.

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