Option Pricing And Portfolio Optimization Modern Methods Of Financial Mathematics Graduate Studies In Mathematics

The present third edition of The Statistical Mechanics of Financial Markets is published only four years after the ?rst edition. The success of the book highlights the interest in a summary of the broad research activities on the application of statistical physics to ?nancial markets. I am very grateful to readers and reviewers for their positive reception and comments. Why then prepare a new edition instead of only reprinting and correcting the second edition? The new edition has been signi?cantly expanded, giving it a more pr- tical twist towards banking. The most important extensions are due to my practical experience as a risk manager in the German Savings Banks' As- ciation (DSGV): Two new chapters on risk management and on the closely related topic of economic and regulatory capital for ?nancial institutions, - spectively, have been added. The chapter on risk management contains both the basics as well as advanced topics, e. g. coherent risk measures, which have not yet reached the statistical physics community interested in ?nancial m- kets. Similarly, it is surprising how little research by academic physicists has appeared on topics relating to Basel II. Basel II is the new capital adequacy framework which will set the standards in risk management in many co- tries for the years to come. Basel II is responsible for many job openings in banks for which physicists are extemely well quali?ed. For these reasons, an outline of Basel II takes a major part of the chapter on capital.

This dissertation, "Asset Pricing, Hedging and Portfolio Optimization" by Jun, Fu, ??, was obtained from The University of Hong Kong (Pokfulam, Hong Kong) and is being sold pursuant to Creative Commons: Attribution 3.0 Hong Kong License. The content of this dissertation has not been altered in any way. We have altered the formatting in order to facilitate the ease of printing and reading of the dissertation. All rights not granted by the above license are retained by the author. Abstract: ?Starting from the most famous Black-Scholes model for the underlying asset price, there has been a large variety of extensions made in recent decades. One main strand is about the models which allow a jump component in the asset price. The first topic of this thesis is about the study of jump risk premium by an equilibrium approach. Different from others, this work provides a more general result by modeling the underlying asset price as the ordinary exponential of a L'vy process. For any given asset price process, the equity premium, pricing kernel and an equilibrium option pricing formula can be derived. Moreover, some empirical evidence such as the negative variance risk premium, implied volatility smirk, and negative skewness risk premium can be well explained by using the relation between the physical and risk-neutral distributions for the jump component. Another strand of the extensions of the Black-Scholes model is about the models which can incorporate stochastic volatility in the asset price. The second topic of this thesis is about the replication of exponential variance, where the key risks are the ones induced by the stochastic volatility and moreover it can be correlated with the returns of the asset, referred to as leverage effect. A time-changed L'vy process is used to incorporate jumps, stochastic volatility and leverage effect all together. The exponential variance can be robustly replicated by European

portfolios, without any specification of a model for the stochastic volatility. Beyond the above asset pricing and hedging, portfolio optimization is also discussed. Based on the Merton (1969, 1971)'s reduced portfolio optimization and the delta hedging problem, a portfolio of an option, the underlying stock and a risk-free bond can be optimized in discrete time and its optimal solution can be shown to be a mixture of the Merton's result and the delta hedging strategy. The main approach is the elasticity approach, which has initially been proposed in continuous time. In addition to the above optimization problem in discrete time, the same topic but in a continuous-time regime-switching market is also presented. The use of regime-switching makes our market incomplete, and makes it difficult to use some approaches which are applicable in complete market. To overcome this challenge, two methods are provided. The first method is that we simply do not price the regime-switching risk when obtaining the risk-neutral probability. Then by the idea of elasticity, the utility maximization problem can be formulated as a stochastic control problem with only a single control variable, and explicit solutions can be obtained. The second method is to introduce a functional operator to general value functions of stochastic control problem in such a way that the optimal value function in our setting can be given by the limit of a sequence of value functions defined by iterating the operator. Hence the original problem can be deduced to an auxiliary optimization problem, which can be solved as if we were in a single-regime market, which is complete. DOI: 10.5353/th_b4819934 Subjects: Capital assets pricing model He

This textbook aims to fill the gap between those that offer a theoretical treatment without many applications and those that present and apply formulas without appropriately deriving them. The balance achieved will give readers a fundamental understanding of key financial ideas and tools that form the basis for building realistic models, including those that may become proprietary. Numerous carefully chosen examples and exercises reinforce the student’s conceptual understanding and facility with applications. The exercises are divided into conceptual, application-based, and theoretical problems, which probe the material deeper. The book is aimed toward advanced undergraduates and first-year graduate students who are new to finance or want a more rigorous treatment of the mathematical models used within. While no background in finance is assumed, prerequisite math courses include multivariable calculus, probability, and linear algebra. The authors introduce additional mathematical tools as needed. The entire textbook is appropriate for a single year-long course on introductory mathematical finance. The self-contained design of the text allows for instructor flexibility in topics courses and those focusing on financial derivatives. Moreover, the text is useful for mathematicians, physicists, and engineers who want to learn finance via an approach that builds their financial intuition and is explicit about model building, as well as business school students who want a treatment of finance that is deeper but not overly theoretical.

This thesis consists of three papers which cover the efficient Monte Carlo simulation in option pricing, the application of realized volatility in trading strategies and geometrical analysis of a four asset mean variance portfolio optimization problem. The first paper studies different efficient simulation methods to price options with different characters such as moneyness and maturity times. The incomplete market environments are also been considered. The second paper uses realized volatility based on high frequency

data to improve the volatility trading strategy. The performance is compared with that using the implied volatility. The last paper re-examines the Markowitz's portfolio optimization problem using a general case. It also extends the problem to four assets, it describes the exact mean variance efficient fronter in the weight space and studies the frontier in the mean variance space. The thesis may serve to help our understanding of how to apply numerical and analytical methods to solve financial problems.

This is a unique book addressing the integration of risk methodology from various fields. It will stimulate intellectual debate and communication across disciplines, promote better risk management practices and contribute to the development of risk management methodologies. Individual chapters explain fundamental risk models and measurement, and address risk and security issues from diverse areas such as finance and insurance, the health sciences, life sciences, engineering and information science. Integrated Risk Sciences is an emerging discipline that considers risks in different fields, aiming at a common language, and at sharing and improving methods developed in different fields. Readers should have a Bachelor degree and have taken at least one basic university course in statistics and probability. The main goal of the book is to provide basic knowledge on risk and security in a common language; the authors have taken particular care to ensure that all content can readily be understood by doctoral students and researchers across disciplines. Each chapter provides simple case studies and examples, open research questions and discussion points, and a selected bibliography inviting readers to further study.

This book combines academic research and practical expertise on alternative assets and trading strategies in a unique way. The asset classes that are discussed include: credit risk, cross-asset derivatives, energy, private equity, freight agreements, alternative real assets (ARA), and socially responsible investments (SRI). The coverage on trading and investment strategies are directed at portfolio insurance, especially constant proportion portfolio insurance (CPPI) and constant proportion debt obligation (CPDO) strategies, robust portfolio optimization, and hedging strategies for exotic options.

This book is written for quantitative finance professionals, students, educators, and mathematically inclined individual investors. It is about some of the latest developments in pricing, hedging, and investing in incomplete markets. With regard to pricing, two frameworks are fully elaborated: neutral and indifference pricing. With regard to hedging, the most conservative and relaxed hedging formulas are derived. With regard to investing, the neutral pricing methodology is also considered as a tool for connecting market asset prices with optimal positions in such assets. Srdjan D. Stojanovic is Professor in the Department of Mathematical Sciences at University of Cincinnati (USA) and Professor in the Center for Financial Engineering at Suzhou University (China).

In Part I, the fundamentals of financial thinking and elementary mathematical methods of finance are presented. The method of presentation is simple enough to bridge the elements of financial arithmetic and complex models of financial math developed in the later parts. It covers characteristics of cash flows, yield curves, and valuation of securities. Part II is devoted to the allocation of funds and risk management: classics (Markowitz theory of portfolio), capital asset pricing model, arbitrage pricing theory, asset & liability management, value at risk. The method explanation takes into account the computational aspects. Part III explains modeling aspects of multistage stochastic programming on a relatively accessible level. It includes a survey of existing software,

links to parametric, multiobjective and dynamic programming, and to probability and statistics. It focuses on scenario-based problems with the problems of scenario generation and output analysis discussed in detail and illustrated within a case study.
This is the first book about the emerging field of utility indifference pricing for valuing derivatives in incomplete markets. René Carmona brings together a who's who of leading experts in the field to provide the definitive introduction for students, scholars, and researchers. Until recently, financial mathematicians and engineers developed pricing and hedging procedures that assumed complete markets. But markets are generally incomplete, and it may be impossible to hedge against all sources of randomness. Indifference Pricing offers cutting-edge procedures developed under more realistic market assumptions. The book begins by introducing the concept of indifference pricing in the simplest possible models of discrete time and finite state spaces where duality theory can be exploited readily. It moves into a more technical discussion of utility indifference pricing for diffusion models, and then addresses problems of optimal design of derivatives by extending the indifference pricing paradigm beyond the realm of utility functions into the realm of dynamic risk measures. Focus then turns to the applications, including portfolio optimization, the pricing of defaultable securities, and weather and commodity derivatives. The book features original mathematical results and an extensive bibliography and indexes. In addition to the editor, the contributors are Pauline Barrieu, Tomasz R. Bielecki, Nicole El Karoui, Robert J. Elliott, Said Hamadène, Vicky Henderson, David Hobson, Aytac Ilhan, Monique Jeanblanc, Mattias Jonsson, Anis Matoussi, Marek Musiela, Ronnie Sircar, John van der Hoek, and Thaleia Zariphopoulou. The first book on utility indifference pricing Explains the fundamentals of indifference pricing, from simple models to the most technical ones Goes beyond utility functions to analyze optimal risk transfer and the theory of dynamic risk measures Covers non-Markovian and partially observed models and applications to portfolio optimization, defaultable securities, static and quadratic hedging, weather derivatives, and commodities Includes extensive bibliography and indexes Provides essential reading for PhD students, researchers, and professionals
This 4-Volume-Set, CCIS 0251 - CCIS 0254, constitutes the refereed proceedings of the International Conference on Informatics Engineering and Information Science, ICIEIS 2011, held in Kuala Lumpur, Malaysia, in November 2011. The 210 revised full papers presented together with invited papers in the 4 volumes were carefully reviewed and selected from numerous submissions. The papers are organized in topical sections on e-learning, information security, software engineering, image processing, algorithms, artificial intelligence and soft computing, e-commerce, data mining, neural networks, social networks, grid computing, biometric technologies, networks, distributed and parallel computing, wireless networks, information and data management, web applications and software systems, multimedia, ad hoc networks, mobile computing, as well as miscellaneous topics in digital information and communications.

This important book brings together an edited series of papers about risk management and the latest developments in the field. Covering topics such as Stochastic Volatility, Risk Dynamics and Portfolio Diversification, this book is vital for optimal portfolio allocation for private and institutional investors, and is an indispensable tool.

This book introduces machine learning methods in finance. It presents a unified treatment of machine learning and various statistical and computational disciplines in quantitative finance, such as financial econometrics and discrete time stochastic control, with an emphasis on how theory and hypothesis tests inform the choice of algorithm for financial data modeling and decision making. With the trend towards increasing computational resources and larger datasets, machine learning has grown into an important skillset for the finance industry. This book is written for advanced graduate students and academics in financial econometrics, mathematical finance and applied statistics, in addition to quants and data scientists in the field of quantitative finance. Machine Learning in Finance: From Theory to Practice is divided into three parts, each part covering theory and applications. The first presents supervised learning for cross-sectional data from both a Bayesian and frequentist perspective. The more advanced material places a firm emphasis on neural networks, including deep learning, as well as Gaussian processes, with examples in investment management and derivative modeling. The second part presents supervised learning for time series data, arguably the most common data type used in finance with examples in trading, stochastic volatility and fixed income modeling. Finally, the third part presents reinforcement learning and its applications in trading, investment and wealth management. Python code examples are provided to support the readers' understanding of the methodologies and applications. The book also includes more than 80 mathematical and programming exercises, with worked solutions available to instructors. As a bridge to research in this emergent field, the final chapter presents the frontiers of machine learning in finance from a researcher's perspective, highlighting how many well-known concepts in statistical physics are likely to emerge as important methodologies for machine learning in finance.

Praise for Robust Portfolio Optimization and Management "In the half century since Harry Markowitz introduced his elegant theory for selecting portfolios, investors and scholars have extended and refined its application to a wide range of real-world problems, culminating in the contents of this masterful book. Fabozzi, Kolm, Pachamanova, and Focardi deserve high praise for producing a technically rigorous yet remarkably accessible guide to the latest advances in portfolio construction." --Mark Kritzman, President and CEO, Windham Capital Management, LLC "The topic of robust optimization (RO) has become 'hot' over the past several years, especially in real-world financial applications. This interest has been sparked, in part, by practitioners who implemented classical portfolio models for asset allocation without considering estimation and model robustness a part of their overall allocation methodology, and experienced poor

performance. Anyone interested in these developments ought to own a copy of this book. The authors cover the recent developments of the RO area in an intuitive, easy-to-read manner, provide numerous examples, and discuss practical considerations. I highly recommend this book to finance professionals and students alike." --John M. Mulvey, Professor of Operations Research and Financial Engineering, Princeton University

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.

The book gives a systematical presentation of stochastic approximation methods for models of American-type options with general pay-off functions for discrete time Markov price processes. Advanced methods combining backward recurrence algorithms for computing of option rewards and general results on convergence of stochastic space skeleton and tree approximations for option rewards are applied to a variety of models of multivariate modulated Markov price processes. The principal novelty of presented results is based on consideration of multivariate modulated Markov price processes and general pay-off functions, which can depend not only on price but also an additional stochastic modulating index component, and use of minimal conditions of smoothness for transition probabilities and pay-off functions, compactness conditions for log-price processes and rate of growth conditions for pay-off functions. The book also contains an extended bibliography of works in the area. This book is the first volume of the comprehensive two volumes monograph. The second volume will present results on structural studies of optimal stopping domains, Monte Carlo based approximation reward algorithms, and convergence of American-type options for autoregressive and continuous time models, as well as results of the corresponding experimental studies.

Understanding and working with the current models of financial markets requires a sound knowledge of the mathematical tools and ideas from which they are built. Banks and financial houses all over the world recognize this and are avidly recruiting mathematicians, physicists, and other scientists with these skills. The mathematics involved in modern finance springs from the heart of probability and analysis: the Ito calculus, stochastic control, differential equations, martingales, and so on. The authors give rigorous treatments of these topics, while always keeping the applications in mind. Thus, the way in which the mathematics is developed is governed by the way it will be used, rather than by the goal of optimal generality. Indeed, most of the purely mathematical topics are treated in extended ``excursions'' from the applications into

the theory. Thus, with the main topic of financial modelling and optimization in view, the reader also obtains a self-contained and complete introduction to the underlying mathematics. This book is specifically designed as a graduate textbook. It could be used for the second part of a course in probability theory, as it includes an applied introduction to the basics of stochastic processes (martingales and Brownian motion) and stochastic calculus. It would also be suitable for a course in continuous-time finance that assumes familiarity with stochastic processes. The prerequisites are basic probability theory and calculus. Some background in stochastic processes would be useful, but not essential. Especially useful for students seeking a lively introduction to Ito calculus. --Short Book Reviews, International Statistical Institute

Optimization models play an increasingly important role in financial decisions. This is the first textbook devoted to explaining how recent advances in optimization models, methods and software can be applied to solve problems in computational finance more efficiently and accurately. Chapters discussing the theory and efficient solution methods for all major classes of optimization problems alternate with chapters illustrating their use in modeling problems of mathematical finance. The reader is guided through topics such as volatility estimation, portfolio optimization problems and constructing an index fund, using techniques such as nonlinear optimization models, quadratic programming formulations and integer programming models respectively. The book is based on Master's courses in financial engineering and comes with worked examples, exercises and case studies. It will be welcomed by applied mathematicians, operational researchers and others who work in mathematical and computational finance and who are seeking a text for self-learning or for use with courses.

This book is a collection of state–of–the–art surveys on various topics in mathematical finance, with an emphasis on recent modelling and computational approaches. The volume is related to a 'Special Semester on Stochastics with Emphasis on Finance' that took place from September to December 2008 at the Johann Radon Institute for Computational and Applied Mathematics of the Austrian Academy of Sciences in Linz, Austria.

In answer to the intense development of new financial products and the increasing complexity of portfolio management theory, Portfolio Optimization and Performance Analysis offers a solid grounding in modern portfolio theory. The book presents both standard and novel results on the axiomatics of the individual choice in an uncertain framework, contains a precise overview of standard portfolio optimization, provides a review of the main results for static and dynamic cases, and shows how theoretical results can be applied to practical and operational portfolio optimization. Divided into four sections that mirror the book's aims, this resource first describes the fundamental results of decision theory, including utility maximization and risk measure minimization. Covering both active and passive portfolio management, the second part discusses standard portfolio optimization and performance measures. The book subsequently introduces dynamic

portfolio optimization based on stochastic control and martingale theory. It also outlines portfolio optimization with market frictions, such as incompleteness, transaction costs, labor income, and random time horizon. The final section applies theoretical results to practical portfolio optimization, including structured portfolio management. It details portfolio insurance methods as well as performance measures for alternative investments, such as hedge funds. Taking into account the different features of portfolio management theory, this book promotes a thorough understanding for students and professionals in the field.

This textbook provides an introduction to financial mathematics and financial engineering for undergraduate students who have completed a three- or four-semester sequence of calculus courses. It introduces the theory of interest, discrete and continuous random variables and probability, stochastic processes, linear programming, the Fundamental Theorem of Finance, option pricing, hedging, and portfolio optimization. This third edition expands on the second by including a new chapter on the extensions of the Black-Scholes model of option pricing and a greater number of exercises at the end of each chapter. More background material and exercises added, with solutions provided to the other chapters, allowing the textbook to better stand alone as an introduction to financial mathematics. The reader progresses from a solid grounding in multivariable calculus through a derivation of the Black-Scholes equation, its solution, properties, and applications. The text attempts to be as self-contained as possible without relying on advanced mathematical and statistical topics. The material presented in this book will adequately prepare the reader for graduate-level study in mathematical finance.

Portfolio optimization problems with transaction costs have been widely studied by both financial economists and financial engineers through various approaches. In this paper, we propose the following approach. In analogy to American option pricing, we study the problem through the Finite Element Method (FEM) combined with an optimization method: We set up a buy-and-hold problem and then we find an optimal set of trades to move to an optimal portfolio whenever the current portfolio is far from the ideal. Local Discontinuous Galerkin (LDG) FEM is used to solve the partial differential equation (PDE) associated with the buy-and-hold problem. Coupled with the Runge-Kutta method for time discretization, this method is local with respect to spatial variable, can be used to achieve any order of accuracy and is explicit in the semi-discrete Ordinary Differential Equation (ODE) form. Also it is amendable to parallel computing. In this paper we give error bounds for the LDG method, with which we establish overall bounds for the portfolio optimization problem and prove the convergence of this method.

This book represents the refereed proceedings of the Eighth International Conference on Monte Carlo (MC)and Quasi-Monte Carlo (QMC) Methods in Scientific Computing, held in Montreal (Canada) in July 2008. It covers the latest theoretical developments as well as important applications of these methods in different areas. It contains two tutorials,

eight invited articles, and 32 carefully selected articles based on the 135 contributed presentations made at the conference. This conference is a major event in Monte Carlo methods and is the premiere event for quasi-Monte Carlo and its combination with Monte Carlo. This series of proceedings volumes is the primary outlet for quasi-Monte Carlo research.

This thesis summarizes most of my recent research in the field of portfolio optimization. The main topics which I have addressed are portfolio problems with stochastic interest rates and portfolio problems with defaultable assets. The starting point for my research was the paper "A stochastic control ap proach to portfolio problems with stochastic interest rates" (jointly with Ralf Korn), in which we solved portfolio problems given a Vasicek term structure of the short rate. Having considered the Vasicek model, it was obvious that I should analyze portfolio problems where the interest rate dynamics are gov erned by other common short rate models. The relevant results are presented in Chapter 2. The second main issue concerns portfolio problems with default able assets modeled in a firm value framework. Since the assets of a firm then correspond to contingent claims on firm value, I searched for a way to easily deal with such claims in portfolio problems. For this reason, I developed the elasticity approach to portfolio optimization which is presented in Chapter 3. However, this way of tackling portfolio problems is not restricted to portfolio problems with default able assets only, but it provides a general framework allowing for a compact formulation of portfolio problems even if interest rates are stochastic.

This book covers the latest approaches and results from reconfigurable computing architectures employed in the finance domain. So-called field-programmable gate arrays (FPGAs) have already shown to outperform standard CPU- and GPU-based computing architectures by far, saving up to 99% of energy depending on the compute tasks. Renowned authors from financial mathematics, computer architecture and finance business introduce the readers into today’s challenges in finance IT, illustrate the most advanced approaches and use cases and present currently known methodologies for integrating FPGAs in finance systems together with latest results. The complete algorithm-to-hardware flow is covered holistically, so this book serves as a hands-on guide for IT managers, researchers and quants/programmers who think about integrating FPGAs into their current IT systems.

Svenja Hager aims at pricing non-standard illiquid portfolio credit derivatives which are related to standard CDO tranches with the same underlying portfolio of obligors. Instead of assuming a homogeneous dependence structure between the default times of different obligors, as it is assumed in the standard market model, the author focuses on the use of heterogeneous correlation structures.

Brownian Motion Calculus presents the basics of Stochastic Calculus with a focus on the valuation of financial derivatives. It is

intended as an accessible introduction to the technical literature. A clear distinction has been made between the mathematics that is convenient for a first introduction, and the more rigorous underpinnings which are best studied from the selected technical references. The inclusion of fully worked out exercises makes the book attractive for self study. Standard probability theory and ordinary calculus are the prerequisites. Summary slides for revision and teaching can be found on the book website.

A comprehensive overview of weak convergence of stochastic processes and its application to the study of financial markets. Split into three parts, the first recalls the mathematics of stochastic processes and stochastic calculus with special emphasis on contiguity properties and weak convergence of stochastic integrals. The second part is devoted to the analysis of financial theory from the convergence point of view. The main problems, which include portfolio optimization, option pricing and hedging are examined, especially when considering discrete-time approximations of continuous-time dynamics. The third part deals with lattice- and tree-based computational procedures for option pricing both on stocks and stochastic bonds. More general discrete approximations are also introduced and detailed. Includes detailed examples.

Each financial crisis calls for — by its novelty and the mechanisms it shares with preceding crises — appropriate means to analyze financial risks. In Extreme Financial Risks and Asset Allocation, the authors present in an accessible and timely manner the concepts, methods, and techniques that are essential for an understanding of these risks in an environment where asset prices are subject to sudden, rough, and unpredictable changes. These phenomena, mathematically known as “jumps”, play an important role in practice. Their quantitative treatment is generally tricky and is sparsely tackled in similar books. One of the main appeals of this book lies in its approachable and concise presentation of the ad hoc mathematical tools without sacrificing the necessary rigor and precision. This book contains theories and methods which are usually found in highly technical mathematics books or in scattered, often very recent, research articles. It is a remarkable pedagogical work that makes these difficult results accessible to a large readership. Researchers, Masters and PhD students, and financial engineers alike will find this book highly useful. Contents:IntroductionMarket FrameworkStatistical Description of MarketsLévy ProcessesStable Distributions and ProcessesLaplace Distributions and ProcessesThe Time Change FrameworkTail DistributionsRisk BudgetsThe Psychology of RiskMonoperiodic Portfolio ChoiceDynamic Portfolio ChoiceConclusion Readership: Researchers, graduate students and financial engineers in the field of mathematical and quantitative finance. Key Features:This book offers an excellent synthesis of the academic literature in a clear, ordered, and intuitive wayThe continuous-time theory of the choice of portfolio is exposed with particular care when asset dynamics are modeled with processes admitting a jump component. This is a technically difficult topic that is tackled here with a lot of clarityThe collated works in this book facilitates access to the most recent techniques, making it user-friendly for readersKeywords:Lévy Process;Extreme Risks;Risk Management;Portfolio Management;Asset AllocationReviews: “A pedagogical work of updated financial models using Lévy processes. Very well written, very well explained and argued with examples and appropriate simulations. Recommended to academics, researchers and PhD students, slightly less to practitioners.” Zentralblatt MATH

This volume contains a collection of papers dedicated to Professor Eckhard Platen to celebrate his 60th birthday, which occurred in 2009. The contributions have been written by a number of his colleagues and co-authors. All papers have been - viewed and presented as keynote talks at the international conference “Quantitative Methods in Finance” (QMF) in Sydney in December 2009. The QMF Conference Series was initiated by Eckhard Platen in 1993 when he was at the Australian - tional University (ANU) in Canberra. Since joining UTS in 1997 the conference came to be organised on a much larger scale and has grown to become a signi?cant international event in quantitative ?nance. Professor Platen has held the Chair of Quantitative Finance at the University of Technology, Sydney (UTS) jointly in the Faculties of Business and Science since 1997. Prior to this appointment, he was the Founding Head of the Centre for Fin- cial Mathematics at the Institute of Advanced Studies at ANU, a position to which he was appointed in 1994. Eckhard completed a PhD in Mathematics at the Technical University in Dresden in 1975 and in 1985 obtained his Doctor of Science degree (Habilitation degree in the German system) from the Academy of Sciences in Berlin where he headed the Stochastics group at the Weierstrass Institute.

A comprehensive overviewof trading and risk management in the energy markets Energy Trading and Risk Management provides a comprehensiveoverview of global energy markets from one of the foremostauthorities on energy derivatives and quantitative finance. With anapproachable writing style, Iris Mack breaks down the three primaryapplications for energy derivatives markets – RiskManagement, Speculation, and Investment Portfolio Diversification– in a way that hedge fund traders, consultants, and energymarket participants can apply in their day to day tradingactivities. Moving from the fundamentals ofenergy markets through simple and complex derivatives trading,hedging strategies, and industry-specific case studies, Dr. Mackwalks readers through energy trading and risk management conceptsat an instructive pace, supporting her explanations with real-worldexamples, illustrations, charts, and precise definitions ofimportant and often-misunderstood terms. From stochastic pricing modelsfor exotic derivatives, to modern portfolio theory (MPT), energyportfolio management (EPM), to case studies dealing specificallywith risk management challenges unique to wind and hydro-electricpower, the bookguides readers through the complex world of energytrading and risk management to help investors, executives, andenergy professionals ensure profitability and optimal riskmitigation in every market climate. Energy Trading and RiskManagement is a great resource to help grapple with the veryinteresting but oftentimes complex issues that arise in energytrading and risk management.

This handbook presents the current state of practice, method and understanding in the field of mathematical finance. Each chapter, written by leading researchers, starts by briefly surveying the existing results for a given topic, then discusses more recent results and, finally, points out open problems with outlines for possible solutions. The primary audiences for the book are doctoral students, researchers and practitioners who already have some basic knowledge of mathematical finance. This comprehensive reference work will be indispensable to readers who need a quick introduction or references to specific topics within this cutting-edge material.

Computationally-intensive tools play an increasingly important role in financial decisions. Many financial problems-ranging from

asset allocation to risk management and from option pricing to model calibration-can be efficiently handled using modern computational techniques. Numerical Methods and Optimization in Finance presents such computational techniques, with an emphasis on simulation and optimization, particularly so-called heuristics. This book treats quantitative analysis as an essentially computational discipline in which applications are put into software form and tested empirically. This revised edition includes two new chapters, a self-contained tutorial on implementing and using heuristics, and an explanation of software used for testing portfolio-selection models. Postgraduate students, researchers in programs on quantitative and computational finance, and practitioners in banks and other financial companies can benefit from this second edition of Numerical Methods and Optimization in Finance. Introduces numerical methods to readers with economics backgrounds Emphasizes core simulation and optimization problems Includes MATLAB and R code for all applications, with sample code in the text and freely available for download

Option Valuation: A First Course in Financial Mathematics provides a straightforward introduction to the mathematics and models used in the valuation of financial derivatives. It examines the principles of option pricing in detail via standard binomial and stochastic calculus models. Developing the requisite mathematical background as needed, the text presents an introduction to probability theory and stochastic calculus suitable for undergraduate students in mathematics, economics, and finance. The first nine chapters of the book describe option valuation techniques in discrete time, focusing on the binomial model. The author shows how the binomial model offers a practical method for pricing options using relatively elementary mathematical tools. The binomial model also enables a clear, concrete exposition of fundamental principles of finance, such as arbitrage and hedging, without the distraction of complex mathematical constructs. The remaining chapters illustrate the theory in continuous time, with an emphasis on the more mathematically sophisticated Black-Scholes-Merton model. Largely self-contained, this classroom-tested text offers a sound introduction to applied probability through a mathematical finance perspective. Numerous examples and exercises help students gain expertise with financial calculus methods and increase their general mathematical sophistication. The exercises range from routine applications to spreadsheet projects to the pricing of a variety of complex financial instruments. Hints and solutions to odd-numbered problems are given in an appendix and a full solutions manual is available for qualifying instructors.

A state-of-the-art introduction to the powerful mathematical and statistical tools used in the field of finance The use of mathematical models and numerical techniques is a practice employed by a growing number of applied mathematicians working on applications in finance. Reflecting this development, Numerical Methods in Finance and Economics: A MATLAB?-Based Introduction, Second Edition bridges the gap between financial theory and computational practice while showing readers how to utilize MATLAB?--the powerful numerical computing environment--for financial applications. The

author provides an essential foundation in finance and numerical analysis in addition to background material for students from both engineering and economics perspectives. A wide range of topics is covered, including standard numerical analysis methods, Monte Carlo methods to simulate systems affected by significant uncertainty, and optimization methods to find an optimal set of decisions. Among this book's most outstanding features is the integration of MATLAB?, which helps students and practitioners solve relevant problems in finance, such as portfolio management and derivatives pricing. This tutorial is useful in connecting theory with practice in the application of classical numerical methods and advanced methods, while illustrating underlying algorithmic concepts in concrete terms. Newly featured in the Second Edition: * In-depth treatment of Monte Carlo methods with due attention paid to variance reduction strategies * New appendix on AMPL in order to better illustrate the optimization models in Chapters 11 and 12 * New chapter on binomial and trinomial lattices * Additional treatment of partial differential equations with two space dimensions * Expanded treatment within the chapter on financial theory to provide a more thorough background for engineers not familiar with finance * New coverage of advanced optimization methods and applications later in the text Numerical Methods in Finance and Economics: A MATLAB?-Based Introduction, Second Edition presents basic treatments and more specialized literature, and it also uses algebraic languages, such as AMPL, to connect the pencil-and-paper statement of an optimization model with its solution by a software library. Offering computational practice in both financial engineering and economics fields, this book equips practitioners with the necessary techniques to measure and manage risk.

Yielding new insights into important market phenomena like asset price bubbles and trading constraints, this is the first textbook to present asset pricing theory using the martingale approach (and all of its extensions). Since the 1970s asset pricing theory has been studied, refined, and extended, and many different approaches can be used to present this material. Existing PhD–level books on this topic are aimed at either economics and business school students or mathematics students. While the first mostly ignore much of the research done in mathematical finance, the second emphasizes mathematical finance but does not focus on the topics of most relevance to economics and business school students. These topics are derivatives pricing and hedging (the Black–Scholes–Merton, the Heath–Jarrow–Morton, and the reduced-form credit risk models), multiple-factor models, characterizing systematic risk, portfolio optimization, market efficiency, and equilibrium (capital asset and consumption) pricing models. This book fills this gap, presenting the relevant topics from mathematical finance, but aimed at Economics and Business School students with strong mathematical backgrounds.

In recent years portfolio optimization and construction methodologies have become an increasingly critical ingredient of asset and fund management, while at the same time portfolio risk assessment has become an essential ingredient in risk

management. This trend will only accelerate in the coming years. This practical handbook fills the gap between current university instruction and current industry practice. It provides a comprehensive computationally-oriented treatment of modern portfolio optimization and construction methods using the powerful NUOPT for S-PLUS optimizer.

This book covers all aspects of modern finance relating to portfolio theory and risk–return relationship, offering a comprehensive guide to the importance, measurement and application of the risk–return hypothesis in portfolio management. It is divided into five parts: Part I discusses the valuation of capital assets and presents various techniques and models used in this context. Part II then addresses market efficiency and capital market models, particularly focusing on measuring market efficiency, which is a crucial factor in making correct investment decisions. It also analyzes the major capital market models like CAPM and APT to determine to what extent they are suitable for use in developing economies. Part III highlights the significance of risk–return analysis as a prerequisite for investment decisions, while Part IV examines the selection and performance appraisals of portfolios against the backdrop of the risk–return relationship. It also examines new tools such as the value-at-risk application for mutual funds and the applications of the price-to-earnings ratio in portfolio performance measurement. Lastly, Part V explores contemporary issues in finance, including the relevance of Islamic finance in the increasingly volatile global financial system.

Presents inference and simulation of stochastic process in the field of model calibration for financial times series modelled by continuous time processes and numerical option pricing. Introduces the bases of probability theory and goes on to explain how to model financial times series with continuous models, how to calibrate them from discrete data and further covers option pricing with one or more underlying assets based on these models. Analysis and implementation of models goes beyond the standard Black and Scholes framework and includes Markov switching models, Lévy models and other models with jumps (e.g. the telegraph process); Topics other than option pricing include: volatility and covariation estimation, change point analysis, asymptotic expansion and classification of financial time series from a statistical viewpoint. The book features problems with solutions and examples. All the examples and R code are available as an additional R package, therefore all the examples can be reproduced.

Understanding and working with the current models of financial markets requires a sound knowledge of the mathematical tools and ideas from which they are built. Banks and financial houses all over the world recognize this and are avidly recruiting mathematicians, physicists, and other scientists with these skills. The mathematics involved in modern finance springs from the heart of probability and analysis, for example: the It calculus, stochastic control, differential equations, and martingales. The authors give rigorous treatments of these topics, while always keeping the applications in mind. Thus, the way in which the mathematics is developed is governed by the way it will be used, rather than by the goal of

optimal generality. Indeed, most of purely mathematical topics are treated in extended excursions from the applications into the theory. Thus, with the main topic of financial modelling and optimization in view, the reader also obtains a self-contained and complete introduction to the underlying mathematics. This book is specifically designed as a graduate textbook.

In an easy-to-understand, nontechnical yet mathematically elegant manner, An Introduction to Exotic Option Pricing shows how to price exotic options, including complex ones, without performing complicated integrations or formally solving partial differential equations (PDEs). The author incorporates much of his own unpublished work, including ideas and techniques new to the general quantitative finance community. The first part of the text presents the necessary financial, mathematical, and statistical background, covering both standard and specialized topics. Using no-arbitrage concepts, the Black–Scholes model, and the fundamental theorem of asset pricing, the author develops such specialized methods as the principle of static replication, the Gaussian shift theorem, and the method of images. A key feature is the application of the Gaussian shift theorem and its multivariate extension to price exotic options without needing a single integration. The second part focuses on applications to exotic option pricing, including dual-expiry, multi-asset rainbow, barrier, lookback, and Asian options. Pushing Black–Scholes option pricing to its limits, the author introduces a powerful formula for pricing a class of multi-asset, multiperiod derivatives. He gives full details of the calculations involved in pricing all of the exotic options. Taking an applied mathematics approach, this book illustrates how to use straightforward techniques to price a wide range of exotic options within the Black–Scholes framework. These methods can even be used as control variates in a Monte Carlo simulation of a stochastic volatility model.