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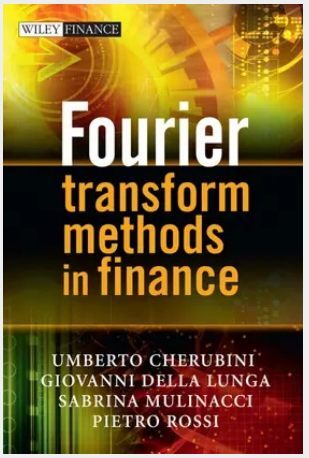
Fourier Transform Methods in Finance



This is the first book written on the application of Fourier transform to finance. Written by an academic and practitioner team, it is an accessible and practical guide to the subject providing an introduction to the mathematics and applications of Fourier transform. Starting with a thorough introduction to the topic, it then looks at recent developments within statistics and finance (jumps, time changes etc) and the problems these have raised in derivatives pricing and risk management. The book then moves onto the technical concepts and application of Fourier transform. It shows practitioners how to apply the tool to price financial instruments such as derivatives, (plain vanilla, barrier options, exotic options etc), to price credit risk applications and manage risk. Contents Chapter 1. From diffusive processes to Lévy processes. A review of the most recent developments of the statistics of financial markets, the inclusion of jumps, time changes and the like, and the problems raised for pricing and risk evaluation Chapter 2. Calculus on complex domain: a primer The reader is introduced to the main technical concepts from complex analysis that will be used throughout the book. Particularly, the reader will be introduced to the concept of path integral in the complex domain. Chapter 3. Option pricing by Fourier transforms The use of Fourier transform in asset pricing is introduced for the simplest products, namely digital products. This enables the reader to learn the basic principles of integration in the complex domain, using Heavyside step functions and Dirac delta function, and applying that directly to solve the basic pricing problem of a Arrow-Debreu securities Chapter 4. Pricing plain vanilla options Fourier transform methods are applied to the price of plain vanilla options. The reader is introduced to the problem first in the standard Black and Scholes model, and then in the Heston model, allowing for stochastic volatility. Some points that are left unexplained in the literature are also tackled. Chapter 5. Pricing barrier options The reader is introduced to frontier issues in the use of Fourier transforms for pricing barrier options. As in the previous chapter, the analysis is first performed in the standard model and then in a more general one. The chapter introduces the reader to Wiener-Hopf factorization techniques. Chapter 6. Pricing exotic options Several applications are proposed for standard classes of univariate exotic options, such as Asian options, lookback, and the like. Chapter 7. Credit risk pricing applications Factor copula models and the generating function technique is introduced, and the Fourier transform approach used in the market is investigated in detail. Chapter 8. Multivariate pricing application The chapter introduces frontiers issues in the topic. The analysis touches upon new results on multivariate analysis for Levy processes and introduces original research and results on the subject, that the group will be developing next year.

99,50 €
92,99 € (zzgl. MwSt.)

Nicht mehr lieferbar

Artikelnummer: 9780470994009
Medium: Buch
ISBN: 978-0-470-99400-9
Verlag: John Wiley & Sons
Erscheinungstermin: 11.12.2009
Sprache(n): Englisch
Auflage: 1. Auflage 2009
Serie: Wiley Finance Series
Produktform: Gebunden
Gewicht: 618 g
Seiten: 256
Format (B x H): 176 x 250 mm

Kundenservice Verlag Dr. Otto Schmidt KG
Neumannstraße 10, 40235 Düsseldorf | kundenservice@otto-schmidt.de | 0221-93738-997 (Inland)