Mathematical Methods for Foreign Exchange:A Financial Engineer's Approach

Alexander Lipton
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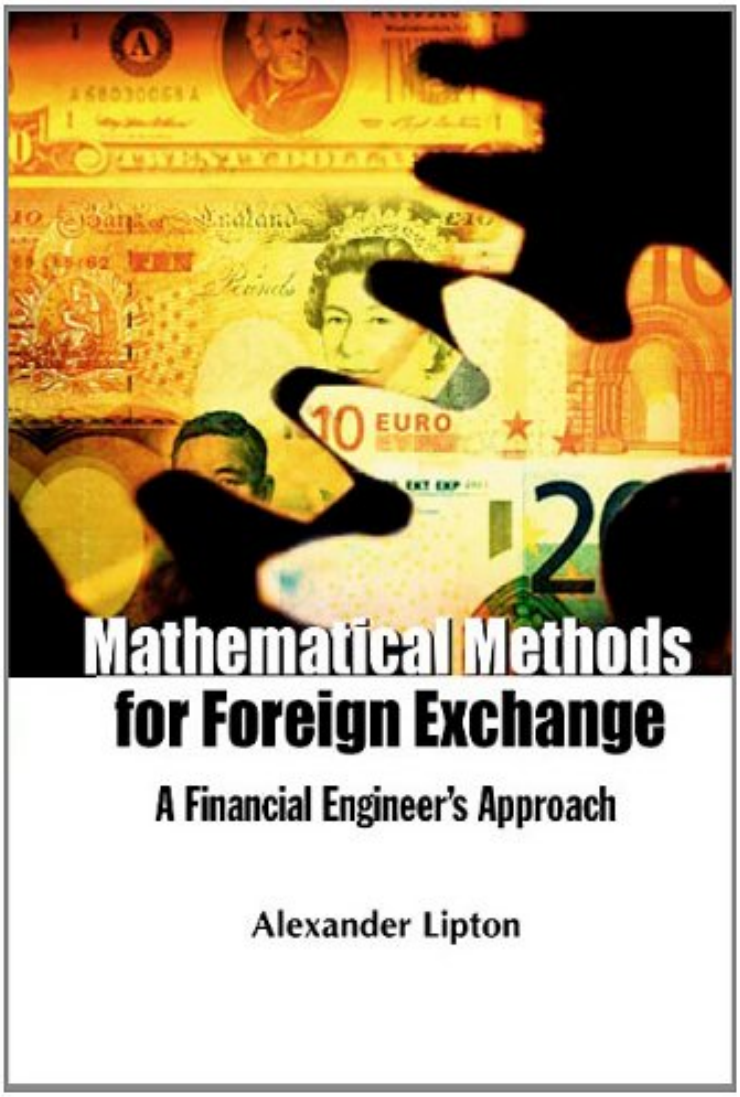

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Alexander Lipton : Mathematical Methods for Foreign Exchange:A Financial Engineer's Approach before purchasing it in order to gage whether or not it would be worth my time, and all praised Mathematical Methods for Foreign Exchange:A Financial Engineer's Approach:

0 of 0 people found the following review helpful. ExcellentBy fadertraderI really like this book; very detailed. Definitely not for a novice to Financial Engineering mathematics. Many good stochastic models although it was written in 2001 so I don't know if there are more modern applications but there is excellent coverage for at least a good base for Fx modeling.5 of 5 people found the following review helpful. One of the most comprehensive books in

quantitative financeBy Grateful ReaderI have been using this book since I was a graduate student and, now working as a quant, I always keep it handy. The various techniques I have learned from this book helped me to solve a lot of problems related to financial engineering which I have encountered in my both academic and professional career. The book covers a lot of advanced material, most of which is original and unique, starting from pricing path-dependent options in the discrete binomial model up to pricing path-dependent volatility products under stochastic volatility models. I will briefly go through the content of the book and make appropriate comments.Chapters 1- 4) The author introduces the sufficient background which is necessary to solve financial problems arising by pricing and risk-managing of derivative securities, in particular, the stochastic calculus and backward/forward partial differential equations (PDE). By itself these topics are nowadays extremely broad and cannot be fully developed even within a series of books. In this book, only important results are given (and references for more specific texts are provided); these results will further be applied throughout the book and they include: basic properties of Brownian motion, connection between the diffusion problems and solutions to backward and forward Kolmogoroff equations, Ito's lemma, solution of SDE-s by discretization, solving PDE-s with Laplace and Fourier transforms, eigenfunction expansion.In chapter 4, the author does tangentially mention about numerical solutions of PDE-s. Here, it is important to note that PDE numerical solution methods are outside of the scope of this book, although the author almost always presents the problem as a solution to certain PDE so a relevant PDE solver can always be applied, the main scope of this book are analytical methods for solving PDEs. However, the author does illustrate the Crank-Nicolson and Crayg-Sneyd ADI scheme, which are the methods of choice (whether robust or not) at the majority of Wall Street firms.Chapters 5-6) The author fully develops the binomial model and carefully explains no-arbitrage pricing principles. What is important and, perhaps, is unique in his treatment of the binomial model is that he describes extensions of the model to the so-called implied trees, and, which is very important for pricing exotic options in the binomial model, he describes the augmentation principle to price path-dependent options, including American, asian, barrier, and lookback options.Chapters 7-9) The author studies continuous time dynamics for FOREX evolution (although by no means is the treatment specific only to FOREX) and pricing principles for European options. He applies various techniques from applied mathematics to solve a variety of pricing problems, including multi-dimensional problems, in an efficient way. These highly useful techniques include non-dimensionalization, Laplace and Fourier transforms, approximations, Green's functions, or the state-price densities in the jargon of finance texts, which are extremely important for solving problems (and building analytics) in their generality .Chapter 10) It is well known that often the pure log-normal model is not satisfactory in practice for pricing and risk-management of derivative deals. To go beyond the Black-Scholes model, the author introduces and discusses a number of possible alternative models for FOREX evolution and shows how to treat these alternative models efficiently using a variety of mathematical tools. In particular, he develops the analytics for the Heston model and derives perturbative expansions for general stochastic volatility models. He also uses this expansion to analyze the properties of the Heston modelChapter 11) I think this is one of the most comprehensive treatments of options with American and Bermudian exercise. The author shows how to solve the problem using PDE, integral equation and approximation methods.Chapters 12-13) These two chapters provide an extremely useful technique for solving a number of complicated problems arising by pricing path-dependent options. The author develops one of the most useful techniques for solving pricing problems of exotic options (and which is completely missing from other quant books) - the augmentation principle that involves introduction of the auxiliary variable describing some functional of the process (for example, its average, maximum, crossing times etc) and augmentation of the pricing PDE with an additional dimension representing the evolution of this auxiliary variable. This augmentation technique is applied to solve a number of problems including pricing of barrier, asian, lookback, Parisian, passport options etc. Let me also note that passport options were originated from the Bankers Trust and the author played a leading role in developing analytics, which is very thoroughly introduced in the book, for these products. He also describes some departures from the log-normal model and shows how to apply alternative models, for example, Heston and CEV models for pricing path-dependent options.Chapter 13 provides one of the most comprehensive in the existing quant literature analytics for path-dependent options. I strongly disagree with one of the reviewers that the author does not explain the Heston model and I point out that the book the reviewer is referring to does not include application of Heston model to pricing forward-start options and options on the asset realized variance. The pricing of European options under the Heston model is by now well documented (needless to say that the author was one of the first to introduce now widely used pricing formula involving one integral as opposed to the original formula including two integrals), however in practice the Heston model is most often applied for pricing volatility products (forward-starts and options on the realized asset variance) and the author does develop the necessary analytics to solve these problems, the part which is missing from existing texts.Finally, Chapter 14 discusses some advanced topics - hedging under model parameter misspecifications, liquidity risks, and counterparty defaults.What makes working on this book enjoyable and rewarding (I must note that it is not a book for after-lunch reading but for hard studying) is that never does the author leave important steps in his derivations omitting rather lengthy but trivial results "for the sake of brevity". Also all author's derivations and conclusions are self-consistent and no external references are made to derive or substantiate a proposition so that you

are never stuck with a problem for which you have to consult other texts (the practice which is often abused in most of the quant finance texts).To conclude, the author, who is one of the top Wall Street quants and applied mathematicians, does not give you a ready solution, discuss a "model calibration" and provide with "code examples", instead he teaches you how to apply the best suited techniques to solve specific problems and makes you participate in his discussion by filling the gaps. For graduate students I can tell that the experience and analytical stamina you get after working on this book are much more valuable in your professional career perspective than all that "light" stuff, including model calibration and implied volatility parametrization, which you will read from some other "quant" books - you will quickly pick that up once you have started your professional quant career.2 of 2 people found the following review helpful. A rare insight into the mathematics of derivativesBy Aleksandar MijatovicAlex Lipton's Mathematical Methods for Foreign Exchange: A Financial Engineer's Approach is a comprehensive study of models used in practice for the pricing and hedging of derivatives. Despite the focus on foreign exchange, the methods detailed in the work go far beyond FX to apply to a number of other asset classes (e.g. equity, commodity, and some fixed income and credit derivatives). The core of the book applies the theory of parabolic partial differential equations to solve a vast number of problems that arise in the pricing of European and path-dependent options. It is difficult to find all the methods covered in the book treated in one place, and many are not documented elsewhere.The emphasis is on a mathematical treatment that highlights the structure of the problems at hand, not on numerical solutions to these problems. Important though numerical solutions are in their own right, they are far less illuminating in understanding the problem itself, and can easily be obtained with the appropriate mathematical tools, developed in this book, at one's disposal. The value of the work is further enhanced by the meticulous referencing and extensive bibliography that it provides.Having worked in the industry as a quant in foreign exchange, and in academia, I can strongly recommend this book to anyone interested in a rigorous mathematical treatment of the problems arising in the pricing and hedging of derivatives.

This comprehensive book presents a systematic and practically oriented approach to mathematical modeling in finance, particularly in the foreign exchange context. It describes all the relevant aspects of financial engineering, including derivative pricing, in detail. The book is self-contained, with the necessary mathematical, economic, and trading background carefully explained. In addition to the lucid treatment of the standard material, it describes many original results.The book can be used both as a text for students of financial engineering, and as a basic reference for risk managers, traders, and academics.Contents:Introduction:Foreign Exchange MarketsMathematical Preliminaries:Elements of Probability TheoryDiscrete-Time Stochastic EnginesContinuous-Time Stochastic EnginesDiscrete-Time Models:Single-Period MarketsMulti-Period MarketsContinuous-Time Models:Stochastic Dynamics of ForexEuropean Options: The Group-Theoretical ApproachEuropean Options, the Classical ApproachDeviations from the Black-Scholes Paradigm I: Nonconstant VolatilityAmerican OptionsPath-Dependent Options I: Barrier OptionsPath-Dependent Options II: Lookback, Asian and other OptionsDeviations from the Black-Scholes Paradigm II: Market FrictionsFuture Directions of Research and ConclusionsReadership: Financial engineering students, risk managers, traders and academics.

"It is a book from which much can be learned, even by specialists in the derivatives field." -- Mathematical s, 2003"The author should be congratulated for his thorough approach to this area..." -- Risk, April 2002...a useful textbook for students of financial engineering and valuable reference book of the research work in financial engineering. -- Mathematics Abstracts...there is much to gain from reading this book, whether one is interested in FX markets or financial engineering. -- GARP Risk , Jul/Aug 2002It's a book that one would happily recommend to any capable student, confident that it is clear, comprehensible and accurate. -- Professor Brian Sutchliffe, Universite Libre de VryxekkesThe author should be congratulated for his thorough approach to this area and the comprehensive list of reference. -- Risk, April 2002 Vol 15 / No. 4there is much to gain from reading this book, whether one is interested in FX markets or in financial engineering -- GARP Risk , Jul/Aug 2002From the PublisherThe book can be used both as a text for students of financial engineering, and as a basic reference for risk managers, traders, and academics.About the AuthorAlexander Lipton, PhD, is a Director in the Global Foreign Exchange Division at Deutsche Bank and an Adjunct Professor of Mathematics at the University of Illinois. In addition to Mathematical Methods for Foreign Exchange, he is the author of one other book, as well as numerous research papers and technical reports on financial engineering and applied mathematics. In January 2000, Dr Lipton became the first recipient of the prestigious Quant of the Year Award by the Magazine Risk.