C++ Design Patterns and Derivatives Pricing.


C++ Design Patterns and Derivatives Pricing examines aspects of mathematical finance and explains how concepts like derivative pricing can be approached using object-oriented programming techniques. The theory of option pricing is revisited, and the two most common pricing techniques, the Monte Carlo and the binomial tree method, are presented and applied to price options from plain vanilla European calls and puts to more sophisticated Asian and American-like options. As with many mathematical problems, when it comes to coding them numerically, the challenge lies in the ability to capture the abstract model in reusable and extendable software. In this book, key abstractions of option pricing are identified, analyzed, and mapped to equivalent C++ programming language paradigms.

In the first half of the book, the author revisits the fundamental concepts of object-oriented programming and exemplifies these by implementing and adding progressive functionality to the payoff class. In a first step, a simple implementation of a plain vanilla option is presented. This class has the advantage that extra forms of payoffs can be added without modifying the main Monte Carlo routine and corresponds to the so-called "open-end" principle that code should be open for extension but closed for modification. To truly achieve this open-end principle, the concepts of inheritance and virtual functions are needed. Chapter 3 shows how inheritance can be coded, whereas Chapter 4 shifs focus to advanced techniques, such as bridging and wrapping. The code can handle any payoff and time-dependent risk-free rates and volatilities. Chapter 5 introduces more advanced techniques, such as a strategy (implemented as C++ templates) to add a so-called "statistics-gatherer object" to the framework to enable monitoring of numerical convergence.

In subsequent chapters, the template design pattern is revisited and exemplified by building a price for exotic, path-dependent options (Chap. 7) or by implementing different types of solvers to handle implied volatilities (Chap. 9).

This book is thought-provoking and rewarding. Even for the less experienced programmer, the presentation is clearly accessible, and the coded examples can be directly used to solve real-life problems. In fact, complete ANSI/ISO-compatible C++ source code is included in an accompanying CD.

In conclusion, this book provides an interesting platform for financial engineering practitioners. I also recommend it for graduate students with basic knowledge of mathematical finance; indeed, there is little need for the reader to have a strong mathematical background. For those readers who already understand finance and C++ programming, reading the book will still be interesting to see how the two topics can be fused.

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An Introduction to Financial Option Valuation: Mathematics, Stochastics and Computation.


The number of books introducing mathematical finance in general, and option pricing in particular, has grown enormously over the last decade. Therefore, a new text on this subject must have a unique feature that makes it attractive compared with existing texts. This book claims to be a lively textbook providing a solid introduction to financial option valuation for undergraduate students armed with only a working knowledge of first-year calculus (quoted from the back page of the book). In nearly all parts of the text, this is indeed true!

In contrast to technically involved or economically based texts at a technically low levels, this book strikes a nice balance in introducing the subject in an elementary way with emphasis on the mathematical side. This concept consists of giving equal attention to aspects of applied mathematics, probability, and computational algorithms. Computational examples, figures, and simulations are intensively used to illustrate formal relations and results. Further, the use and presentation of MATLAB code is an excellent supplement for teachers of an introductory course on the subject. Because the textbook is aimed at the undergraduate level, stochastic calculus is avoided. Of course, this does not mean that stochastic calculus is not essential for modern finance. To underline this, the author explicitly indicates when a heuristic derivation is given.

The book comprises 24 chapters that cover a wide range of the standard problems of option valuation and numerical algorithms used therein. The main areas treated are as follows (in order of appearance):

- Basics and introduction (options, option valuation preliminaries, random variables, computer simulation)
- Asset prices (asset price movements and models)
- Option pricing (Black–Scholes partial differential equation and formulas, hedging, the Greeks, risk neutrality, implied volatility)
- Numerical methods (nonlinear equations, Monte Carlo basics, binomial method)
- Further aspects of options (cash-or-nothing options, American options, exotic options, historical volatility)
- More on numerical methods (variance reduction for Monte Carlo methods, finite-difference methods).

The introductory part is well motivated, and the necessary economic background is presented in a clear, concise way that quotes various important aspects at the end of each section. The subject on asset prices is presented in a pedagogical manner. The few hand-waving arguments used to derive the continuous-time limit of the discrete asset price models are compensated for by well-chosen simulation examples that provide good computational insight. The only drawback of the book lies in the derivation of the Black–Scholes equation. Here the heuristics get a little vague. On the positive side, the first option pricing section contains many good and easy-to-understand insights into hedging, the role of the Greeks, and implied volatility. In particular, introducing such standard numerical methods as the Newton algorithm in the context of finance is a nice idea.

The direct Newton algorithm application for solving equations characterizing implied volatility underlines its importance and usefulness. The introduction of the binomial method and the basic Monte Carlo algorithm is standard. Presenting further types of exotic options, historical volatility and standard Monte Carlo variance reduction techniques, together with finite difference methods to solve partial differential equations, form the remaining part of the book.

Overall, this book has a very convincing concept. It is not just another introduction into option pricing, but rather an introduction into applied mathematics with an emphasis on option pricing. The reader simultaneously learns the basics of numerical analysis, probability, simulation, and even MATLAB code. These features are paired with carefully chosen comments on various mathematical and financial aspects. On top of that, there is a good collection of exercises. Of course, the book is not an advanced text enabling one to conduct research in continuous-time finance, but it is a very readable and accessible text for undergraduates and would make a perfect basis for preparing an undergraduate lecture series on option valuation as application of probabilistic modeling and numerical analysis.

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Finite-Sample Econometrics: Advanced Texts in Econometrics.


Classical statistics and econometrics theory typically relies on asymptotic results. Exact finite-sample results are in general available only for simple estimators and/or under particular distributional assumptions on the observations (for instance normality). However, in many situations, the asymptotic properties of estimators and tests are not accurate approximations of their finite-sample behavior and a quick look at the econometric literature sometimes gives the impression that the purpose of asymptotic theory is no longer (to quote John W. Tukey) “to provide usable approximations before passage to the limit.” From this point of view, this book is a welcome addition to the literature. It is a unique collection of results scattered elsewhere and presented here in a unified framework.

After the introduction, Chapters 2 and 3 are devoted to the computation of exact finite sample moments and distributions. The approach of the au-