

FIN6930 Introduction to Computational Methods for Derivatives Pricing

Course Description: The course will provide practical applications of MATLAB functions and programming to fundamental financial instruments, such as bonds and stocks, and their derivatives. Though this is an introductory course where mathematical and programming tools will be kept at a basic level, students must be familiar with undergraduate calculus and be comfortable with elementary programming.

Topics covered:

Fixed-income securities: analysis and portfolio immunization

- * Compounding and interest value
- * Basic pricing of fixed-income securities
- * Interest rate sensitivities and bond portfolio immunization
- * MATLAB functions for fixed-income securities

Portfolio optimization

- * Mean-variance optimization
- * Alternative measures:
 - Value-at-Risk and quantile-based measures

Derivatives pricing

- * Binomial model
- * Black-Scholes model
- * American options
- * Path-dependent options: barrier, Asian, and lookback

Numerical methods

- * Issues in numerical computations (error propagation, conditioning, stability)
- * Numerical integration
- * Monte Carlo method
- * Finite-difference and partial differential equations (Crank-Nicolson scheme)

Prerequisites: FIN 5437, FIN 5439, or MSF student.

Textbook: *Numerical Methods in Finance and Economics: A MATLAB-Based Introduction*, by Paolo Brandimarte, published by Wiley (2006). We will cover only a small portion of the material included in this book (mostly, chapters 1, 2, 7, 8, and 9.)

Grading:

It will be based on programming assignments (three or four) and class participation (80% and 20%, respectively.)