Numerical methods in financial engineering

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Course : 18 hours - TP : 9 hours

Objectives

The course focuses on numerical methods for EDPs in finance: pricing methods (numerical calculation of prices and Greeks of derivatives) and model calibration methods..

Outline

- Fourier Transform Pricing Methods.
- Tree Pricing Methods - Cox Ross Rubinstein Binomial Tree. Trinomial Tree by Kamrad Ritchken. Case Study: Barrier and Bermuda shorts options.
- Finite Difference Pricing Methods - Theta-Schemes in Dimension One Space. ADI method in upper dimension. Case Study: Asian Options, Clicks, Volatility and Variance Swaps.
- Calibration Methods - Calibration of non-linear least squares parametric models. Calibration of nonparametric nonlinear regularized least squares models. Case Study: Effective Volatility Extraction.

Bibliography

- AVELLANEDA M. and LAURENCE P. (2000) : *Quantitative Modeling of Derivative Securities: From Theory to Practice*, Chapman & Hall.
- CONT R. and TANKOV P. (2003) : *Modelling with Jump Processes*, Chapman & Hall.
- GATHERAL J. (2006) : *Volatility Surface: A Practitioner's Guide*. Wiley.
- KWOK Y.W. (1998) : *Mathematical models of financial derivatives*, Springer (2nd edition à paraître).
- LAMBERTON D. et LAPEYRE B. (1997) : *Introduction au Calcul Stochastique Appliquée à la Finance*. Editions Eyrolles.