premia

A platform for pricing financial derivatives

Efficient computation of prices and hedges for derivative products is a major issue for financial institutions. The development of increasingly complex financial products requires advanced stochastic and numerical analysis techniques.

Premia software is designed for pricing and hedging equity, interest rate, credit and energy derivatives.

Premia, a powerful tool for professional research teams in computational finance

Major features of Premia

- A collection of C/C++ routines and scientific documentation (PDF and HTML) for recent algorithms for option pricing, hedging and model calibration
- A powerful testing platform for comparing various methods
- A link between professional financial teams and academic researchers
- A useful teaching support for master and PhD students

Premia Team

- PREMIA is developed by the MATHFI research team uniting scientists in probability, numerical analysis and finance from INRIA and ENPC (France)
  www-rocq.inria.fr/mathfi/
- From 2007, the University of Osaka (Japan) will join the team.

Premia Consortium

Premia is developed in interaction with a consortium of financial institutions or departments:

Calyon,
EDF,
Natixis,
and Société Générale Corporate & Investment Banking.

The consortium members contribute to finance the development and help to determine the directions of future research.

Every year, a new release is delivered to the consortium members and the release n-2 becomes available on Premia web site : www.premia.fr

Platforms and interfaces

Available for Linux and Windows operating systems

User interface through command-line interaction with possibility to generate PDF reports

Scilab/Nsp and Excel interfaces

Premia Content

ALGORITHMS

Pricing algorithms

- Finite differences and finite elements for pricing PDE's
- Monte Carlo methods
- Tree methods
- Approximation methods

Hedging algorithms

Calibration algorithms

FINANCIAL PRODUCTS

Equity derivatives: European, American, Barrier, Lookback, Asian, Multi-asset options

- Black-Scholes model (up to dimension 10)
- Stochastic volatility models (Dupire, Hull-White, Heston, Fouque-Papanicolaou-Sircar)
- Models with jumps (Merton, Variance Gamma, NIG, Kou, CGMY, Tempered stable)
- Bates model (model with stochastic volatility jumps)

Interest rate derivatives: Options on Zero Coupon Bond, Caps/Floors, Swaptions, Bermudan Swaptions, Exotic products

- Affine models
- HJM models (Hull-White, Extended CIR, Black-Karasinski, Squared-Gaussian, Li-Ritchken-Sankarasubramanian, Bhar-Chiarella)
- LIBOR Market Models (LMM)
- LMM with stochastic volatility
- LMM with jumps
- Markov-functional interest rate models (Hunt-Kennedy-Pellser)

Credit derivatives: CDS, CDO and CDO^2

- Reduced form models (Hull-White, Extended CIR)
- Copula models

Energy derivatives: Swing options

- Jump models

Main algorithms

EQUITY DERIVATIVES

Pricing and Hedging

- Finite differences
  - Finite differences for Asian and Lookback options
  - Finite differences for Lévy models
  - Finite differences for stochastic volatility models
  - Finite elements adaptive methods for local volatility models
- Monte Carlo methods
  - Low discrepancy sequences
  - Various variance reduction methods
  - Malliavin approach for computations of the Greeks
  - Large deviations technics for barrier options (Baldi-Caramellino-Iovino)
  - American Monte Carlo methods (Longstaff-Schwartz, Tsitsiklis-VanRoy, Barraquand-Martineau, Pagès-Bally, Broadie-Glassermann, Rogers, Malliavin approach)
- Tree methods
  - Barrier options (Ritchken, Cheuk-Vorst, Derman-Kani-Ergener-Bardhan, Rogers-Stapleton)
  - Asian options (Barraquand-Pudet, Hull-White)
- Approximation methods
  - Asian options (Thompson, Fusai-Tagliani, Laplace/Fourier algorithm, Zhang)
  - Carr-Madan FFT algorithm in Lévy models and Bates model

Dynamic Hedging

- Dynamic Hedging in Black-Scholes model
- Dynamic Hedging in Lévy models

Calibration

- Dupire model (Lagnado-Osher, Avellaneda, Bally-Temam)
- Bates model

INTEREST RATE DERIVATIVES

Pricing and Hedging

- Finite differences
  - ADI finite differences in Bhar-Chiarella model
- Monte Carlo methods
  - Monte Carlo for bermudan swaptions (Pedersen, Andersen, Kolodko-Schoenmakers, Carr-Yang)
  - Arbitrage-free discretization (Glassermann)
  - Glasserman-Merener algorithm in the LMM-jump model
- Tree methods
  - Hull-White algorithm
  - Schmidt lattice algorithms
  - Li-Ritchken-Sankarasub-ramanian lattice algorithm
  - Bushy tree algorithm in LMM

Calibration

- LMM models. Calibration of swaps and caps market data

CREDIT DERIVATIVES

Pricing and Hedging

- Schönbucher tree algorithm
- Brigo-Alfonsi Derivatives pricing with the SSRD stochastic intensity model
- Hull-White CDO algorithms
- Laurent-Gregory algorithms

ENERGY DERIVATIVES

Pricing and Hedging

- Malliavin algorithm
- Quantization algorithm
- Finite differences

http://www.premia.fr

ECOLE NATIONALE
DES PONTS ET CHAUSSEES

INSTITUT NATIONAL
DE RECHERCHE
EN INFORMATIQUE
ET EN AUTOMATIQUE

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