Premia : An Option Pricing Platform

http://www.premia.fr

MATHFI Project
Outline

1. What is PREMIA?

2. How does PREMIA work?

3. What is inside PREMIA?
PREMIA: a powerful tool for R&D teams

- PREMIA is a research software
- A collection of C/C++ algorithms for pricing and hedging derivatives and calibrating models. Each algorithm is accompanied by a detailed scientific documentation.
- Since 2007, a unified numerical library (PNL) has been available for contributors. PNL will be released under the LPGL license within a few months.
- A powerful testing platform for comparing different algorithms.
- A bridge between professional financial teams and academic researchers: banks get involved in academic research.
Premia team

- **Head of development**: Jérôme Lelong (ENSIMAG) & Antonino Zanette (Univ. Udine)
- **Professors of the Mathfi Project**: (INRIA (Agnès Sulem), ENPC (Bernard Lapeyre, Benjamin Jourdain,Aurélien Alfonsi), Univ. of Marne-la-Vallée (Damien Lamberton, Vlad Bally))
- **Development engineer (full-time) every year**: I. Laachir
- **Partner collaborators**: A. Kebaier (Univ. Paris 13), C. Labart (Univ. Paris 6)
- **Partner professors from foreign institutions**: A. Kohatsu Higa (Univ. Osaka), N. Privault (Univ. Hong-Kong), J. Teichmann (Univ. Vienna), C. Bayer (Univ. Stockholm), S. Levendorski (Univ. Leicestershire), N. Boyarchenko (Univ. of Chicago), O. Kudrayetsev (Univ. Rostov), S. Ninomiya (Tokyo Institute of Technology), G. Fusai (Univ. Novara), L. Caramellino (Univ. Roma Tor Vergata), M. Vellekoop (Univ. Amsterdam), L. Veraart (Univ. Karlsruhe),...
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The consortium provides a financial support to the development and a valuable help to determine the directions of future research.

A new release of Premia is delivered every year. Two years after its release, a version of Premia becomes freely available. The source code and the documentation can be downloaded from Premia’s web site (http://www.premia.fr).
The consortium

• The members of the consortium get the complete source code and documentation.
• They take part to the annual delivery meetings and discuss future evolutions of the software.
• They use PREMIA for their own needs and to develop composite or derived works.
• A email address is available for questions premia@inria.fr
Models, products and algorithms

Algorithms

- Pricing: Finite differences, Monte Carlo, Tree methods, Approximation methods, Closed formulas
- Calibration (Equity, Toolbox for LMM with market data provided by Natixis)

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

- Multi-dimensional Black-Scholes, Dupire
- Stochastic volatility (Heston, Hull/White, Fouque-Papanicolaou-Sircar)
- Models with jumps (Merton, Variance Gamma, NIG, Kou, Tempered stable)
- Bates model

Interest rate: caps/floors, Euro and Bermudean swaptions, options on bonds

- Affine models
- HJM
- LMM (with jumps, stochastic volatility)
- QTSM

Credit: CDS, CDO

- Reduced form models (Hull-White, Extended CIR)
- Copula models
- Dynamic models for CDOs
- Dynamic hedging of CDOs

Energy: Swing options

- Jump models

Volatility products, Insurance
Software platforms and user interfaces

- Can be compiled under Unix and Windows: we give binary versions for Linux and Windows.
- A Visual C++ project is delivered for compilation under Windows.
- Excel and Nsp interfaces to Premia.
- The command-line interface has the ability to generate PDF reports.
- A Scientific documentation of all the methods implemented is available both in PDF and HTML.
Nsp bindings and a GUI

- Nsp is a Matlab-like scientific software.
- Pricing methods can be called using a scripting language.
- A pricing problem is represented by an object and many functions can operate on them.
- A Graphical interface has been written using Gtk bindings for Nsp. All the choices of models, options and methods are accessible through menus.
- Premia problems can be saved on disk and reloaded later.
- Possibility to run Premia/Nsp on a cluster using the MPI toolbox (within Nsp) to price a large portfolio of claims. Tests have been run on portfolios of 10,000 claims. 
  http://cermics.enpc.fr/~lelong/gcpmf
- We have an automatic procedure to test all the algorithms. Thanks to the MPI toolbox, this procedure runs on a cluster.