

**PDE in Finance**  
**Spring 2009**  
**Instructor: Marco Avellaneda**

**Syllabus**

1. The Heat Diffusion Equation
2. Ito Calculus and Expectation of Functionals of Diffusion Processes
3. The Black-Scholes PDE
4. Trinomial Trees and Finite-Difference Schemes
5. Barrier Options
6. Uncertain Volatility Model
7. Option Spreads and Exotic Options: Valuation and Hedging
8. Stochastic Volatility Models
9. Volatility Skew
10. Steepest-Descent Approximations for Heat Kernels
11. Basket Options and Dispersion Trading, Spread Options
12. Stochastic Optimal Control and Applications to Financial Modeling
13. Stock Pinning on Option Expiration Dates

**References**

1. Robert V. Kohn, *Lecture Notes on PDEs in Finance*  
[http://www.math.nyu.edu/faculty/kohn/pde\\_finance.html](http://www.math.nyu.edu/faculty/kohn/pde_finance.html)
2. Marco Avellaneda and Peter Laurence, *Quantitative Analysis of Derivative Securities: From Theory to Practice*, CRC Press, 2000
3. Jim Gatheral, *The Volatility Surface*, Wiley Finance, 2004
4. Robert Buff, *Uncertain Volatility Models*, Springer Finance, 2002
5. Marco Avellaneda, D. Boyer-Olson, J. Busca, P. Friz, *Reconstructing Volatility*, Risk, 2002, <http://www.math.nyu.edu/faculty/avellane/Papers.html>