

Marco Avellaneda

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Education

Licentiate in Mathematical Sciences (B.S. /M.S.), 1981, University of Buenos Aires

Ph.D. in Mathematics (Probability), 1985, University of Minnesota

Academic

09/85 – Present Date: **New York University, Courant Institute of Mathematical Sciences**

Director, Division of Financial Mathematics	1998 -
Professor of Mathematics	1995 -
Associate Professor (tenure)	1990 - 1995
Assistant Professor	1988 - 1990
Research Scientist	1987 - 1988
Instructor	1985 – 1987

Research interests: Applied Mathematics, Applied Physics, Mathematical Finance, Econometrics of Financial Markets, Derivative Securities, Risk-management. Directed 15 doctoral dissertations since 1988

Industry Research in Finance

1/2004-1/2005: **Capital Fund Management, S.A. (Paris)** (Leave of absence from NYU)
Head of Volatility Arbitrage (Nimbus Hedge Fund)

Main activity: Directed team of 4 people that developed a new hedge fund specialized in trading options

- Developed relative-value trading strategies using equity options
- Back-tested RV strategies using US options database
- Directed team of programmers in implementation of full-scale trading platform
- Negotiated fees and market access with prime brokers
- Traded the strategies (90% electronic, 10% voice on CBOE)
- Participated actively in marketing of the fund to institutional investors
- Developed Eurozone strategy (not implemented)

12/96 - 02/98: **Morgan Stanley Dean Witter** (Leave of absence from NYU)
Vice-President, Fixed-Income Research, Derivative Products Group

Consulting & Other Finance-related Activities

1/2004-present: **Finance Concepts SARL**
Founding Partner

Finance Concepts has 7 co-workers. Recipient of the 2004 ANVAR Prize for Young Innovating Company. Clients from 2004 to 2007 included Fortune 500 banks and corporations, such as Total, Cisco Systems, Mizuho Bank and Societe Generale

2/2002-1/2003 **Royal Bank of Canada Capital Markets**
Consultant to the Head of Trading and Research of Structured Credit Derivatives

1/2001-5/2003: **Gargoyle Strategic Investments, LLC.**
Partner, Proprietary Trading, Listed Equity Options

6/1999-9/1999: **BNP Paribas, Fixed-Income Research**
Consultant to the Head of Research

1/1998-12/1998: **Morgan Stanley & Co**
Consultant to the Model Review Committee, and to the Head of Fixed-Income Research

3/1996-8/1996: **Banque Indosuez, New York**
Consultant to the Foreign-Exchange Derivatives Trading Desk

Academic Service

9/1995-present: **Courant Institute Mathematical Finance Seminar**
This venue brings together academics and practitioners in Mathematical Finance in a New York City event every week. It was one of the first seminars in Mathematical Finance in the country that promoted exchanges between the university and the finance community

1/2004-present: **University of Coimbra, Portugal, International Center for Mathematics**
Member, Scientific Program Committee

1/2004-4/2004: **Institute for Mathematics and Its Applications, University of Minnesota**
Lead Organizer, Period of Concentration of Mathematical Finance

1/2003 to 12/2003: **University of Nice**
Visiting Professor, Institut J. Dieudonne

1/2002-12/2004: **American Mathematical Society, Committee of Science Policy**
Appointed Member. Committee duties involved meeting with U.S. Representatives and staff on science policy matters

12/1996 -1/1997: **Ecole Polytechnique**
Member, review panel for 5-year assessment of the Applied Mathematics Laboratory (CNRS)

9/1995-5/1996: **Institute for Advanced Studies**
Visiting Member

1991- 1998: **Short-term summer academic appointments**

University of Paris VI, University of Paris VII, ETH-Zurich, Ecole Normale Supérieure de Cachan, Ecole Polytechnique, IMPA-Rio de Janeiro, University of Buenos Aires, Universidad Menéndez-Pelayo (Spain)

Selected Invited Conferences

Institut Henri Poincaré, *Conference in Honor of Nicole El Karoui*, 2004

Stanford University, *Conference in Honor of George Papanicolaou's 60th birthday*, 2003

Scuola Normale Superiore di Pisa, *Cattedra Galileiana*, 2001

International Congress of Mathematicians, Berlin, 1998, Invited 30 minute address

International Congress of Mathematicians, Zurich, 1994, Invited 30 minute address

Books and Editorial

Quantitative Modeling of Derivative Securities (with Peter Laurence), CRC Press, 1999

Quantitative Analysis in Financial Markets, Vols. I, II, III, World Scientific, 1999, 2000, 2001

International Journal for Theoretical and Applied Finance, Managing Editor, 1998- present

Proceedings of IMA Workshop of Financial Modeling, Springer, 2005 (with Rama Cont)

Communications on Pure and Applied Mathematics, Editorial Board Member

List of Publications

Attached separately

Certifications

NASD Series 7 and Series 63

Languages

English, Spanish, Portuguese, French, written and spoken fluently

Italian, conversational

Brief Biography

Elementary and high-school years in Rio de Janeiro, Buenos Aires and Paris. Moved from Europe to South America in 1970. Lived in Rio de Janeiro until mid-seventies and obtained a BS/MS in Mathematics at the University of Buenos Aires in 1981. Graduate studies at the University of Minnesota in the early 1980's. Joined the faculty of New York University in 1985. Extensive travel, with frequent visits to Latin America and Europe. U.S. Citizen since October 2002. Research focuses on the application of mathematics and statistics to real-life situations, and the development of technology that uses mathematics to handle information and data in real-time, such as statistical trading algorithms and risk-management.

List of Publications
Updated December 12, 2007

Quantitative Finance

1. M Avellaneda and S Stoikov, High-frequency trading in a limit order book, *Quant. Finance* 2008
2. M Avellaneda, A look ahead at options pricing and volatility, *Quantitative Finance*, 2004
3. M Avellaneda, MD Lipkin, A market-induced mechanism for stock pinning, *Quantitative Finance*, 2003
4. M Avellaneda, D. Boyer-Olson, J. Busca, P. Friz, Reconstruction of Volatility: Pricing Index Options by the Steepest Descent Approximation, *RISK*, 2003
5. J Kampen, M Avellaneda, On parabolic equations with gauge function term and applications to the multidimensional Leland Equations, *Applied Mathematical Finance*, 2003
6. M Avellaneda, D Boyer-Olson, J Busca, P Friz, Application of large deviation methods to the pricing of index options in finance, *Comptes rendus de l'Académie des Sciences de Paris, Mathématique*, 2003
7. R Cont, M Avellaneda, Introduction to the special issue on volatility modeling, *Quantitative Finance*, 2002
8. KP Scherer, M Avellaneda, All for One and One for All? A Principal Component Analysis of Latin American Brady Bond Debt from 1994 to 2000, *International Journal of Theoretical and Applied Finance*, 2002
9. M Avellaneda, L Wu, Credit contagion: Pricing cross-country risk in Brady debt markets *International Journal of Theoretical and Applied Finance*, 2001
10. M Avellaneda, J Zhu, Distance to default, *RISK*, 2001, Distancia al Incumplimiento, *Spanish RISK*, 2002
11. M Avellaneda, R Gamba, Conquering the Greeks in Monte Carlo: efficient calculation of the market sensitivities and hedge-ratios of financial asset via Monte Carlo simulation, in *Proceedings of the First Bachelier Congress*, 2001, and in *Quantitative Analysis in Financial Markets*, vol II, 2001

12. M. Avellaneda, R Buff, C. Friedman, N Grandchamp, L. Kruk, Weighted Monte-Carlo: A new technique for calibrating asset-pricing models, *International Journal of Theoretical and Applied Finance*, 2001
13. M Avellaneda, Variance Swap Volatility and Option Strategies, *Derivatives Week*, Nov 2000
14. M Avellaneda, P Laurence, *Quantitative Modeling of Derivative Securities: From Theory to Practice*, Chapman-Hall, 2000
15. M Avellaneda, R Buff, Combinatorial implications of nonlinear uncertain volatility models: the case of barrier options, *Applied Mathematical Finance*, 1999
16. M Avellaneda, An Introduction to Option Pricing and the Mathematical Theory of Risk, *Probability Theory and Applications*, 1999
17. M Avellaneda, L Wu, Pricing Parisian-style options with a lattice method, *International Journal of Theoretical and Applied Finance*, 1999
18. M Avellaneda, editor: *Quantitative Analysis in Financial Markets: Collected Papers of the New York University Mathematical Finance Seminar Volumes I,II, III*, World Scientific, 1999, 2000, 2001
19. Y Zhu, M Avellaneda, A risk-neutral stochastic volatility model, *International Journal of Theoretical and Applied Finance*, 1998
20. M Avellaneda and J. Newman, Positive Interest Rates and Non-Linear Term-structure models, unpublished, *CIMS-NYU Working Paper*, 1998
21. M Avellaneda, A Carelli, F Stella, Following The Bayes Path to Option Pricing, *J. of Computational Intelligence in Finance*, 1998
22. M Avellaneda, Minimum-relative-entropy calibration of asset pricing models, *International Journal of Theoretical and Applied Finance*, 1998
23. M Avellaneda, The Minimum-Entropy Algorithm and Related Methods for Calibrating Asset-Pricing Models, *Proceedings of the International Congress of Mathematicians, Documenta Mathematica*, 1998
24. Y Zhu, M Avellaneda, An E-ARCH model for the term structure of implied volatility of FX options, *Applied Mathematical Finance*, 1997
25. M Avellaneda, C Friedman, R Holmes, D Samperi, Calibrating volatility surfaces via relative-entropy minimization, *Applied Mathematical Finance*, 1997

26. M Avellaneda, A Paras, Managing the volatility risk of portfolios of derivative securities: the Lagrangian uncertain volatility model. *Applied Mathematical Finance*, 1996
27. P Lewicki, M Avellaneda, Pricing Interest Rate Contingent Claims in Markets with Uncertain Volatilities, *Working Paper, Courant Institute of Mathematical Sciences* 1996
28. M Avellaneda, A Levy and A Paras, Pricing and Hedging Derivative Securities in Markets with Uncertain Volatility, *Applied Mathematical Finance*, 1995
29. M Avellaneda, Antonio Paras, Dynamic hedging portfolios for derivative securities in the presence of large transaction costs, *Applied Mathematical Finance*, 1994

Statistics and Approximation Theory

30. G Davis, S Mallat, M Avellaneda, Adaptive greedy approximations, *J. Constructive Approximations*, 1997

Turbulence and Turbulent Diffusion

31. C Apelian, RL Holmes, M Avellaneda, A turbulent transport model: Streamline results for a class of random velocity fields in the plane, *Communications on Pure and Applied Mathematics*, 1997
32. Avellaneda, M., Homogenization and renormalization, the mathematics of multi-scale random media and turbulent diffusion. In *Dynamical Systems and Probabilistic Methods in Partial Differential Equations* (P. Deift, C. D. Levermore and C. E. Wayne, eds.) 251--268. Amer. Math. Soc., Providence, RI, 1996
33. M. Vergassola and Avellaneda, M. Scalar Transport in Compressible Flow, *Physica D*, 1995
34. Marco Avellaneda, Andrew J. Majda, Simple Examples with Features of Renormalization for Turbulent Transport, *Philosophical Transactions: Physical Sciences and Engineering*, Vol. 346, No. 1679, Mathematics of Nonlinear System (1994), pp. 205-233

35. Avellaneda M, Apelian C, Elliott Jr. F, Trapping, percolation and anomalous diffusion of particles in a two-dimensional flow. *J. Statist. Phys.* 72, 1993
36. M Avellaneda, AJ Majda, Renormalization theory for eddy diffusivity in turbulent transport, *Physical Review Letters*, 1992
37. Avellaneda, M, Majda A. J, Application of an approximate R-N-G theory, to a model for turbulent transport with exact renormalization, in *Turbulence in Fluid Flow*, IMA, Vol 55, 1993
38. Avellaneda, M; Majda, A Mathematical models with exact renormalization for turbulent transport. II. Fractal interfaces, non-Gaussian statistics and the sweeping effect. *Comm. Math. Phys.* 146, 1992,
39. M Avellaneda, AJ Majda , Approximate and exact renormalization theories for a model for turbulent transport, *Physics of Fluids A: Fluid Dynamics*, 1992
40. M. Avellaneda, A.J. Majda, Superdiffusion in nearly stratified flows, *J. Stat. Phys.* 69 (3/4) (1992)
41. M. Avellaneda and A. Majda An integral representation and bounds on the effective diffusivity in passive advection by laminar and turbulent flows. *Commun. Math. Phys.* **138** , 339-391, (1991)
42. M. Avellaneda, S. Torquato, I C Kim, Diffusion and geometric effects in passive advection by random arrays of vortices, *Physics of Fluids A*, 1991
43. M Avellaneda, AJ Majda, Homogenization and renormalization of multiple-scattering expansions for Green functions in Turbulent Transport, in *Composite media and homogenization theory*, *Proc. Int. Cent. Theoretical Physics*, 1990
44. Avellaneda, M. and Majda, A. Mathematical models with exact renormalization for turbulent transport. *Comm. Math. Phys.* **131** 381—429, 1990
45. M Avellaneda, AJ Majda, Stieltjes Integral Representation and Effective Diffusivity Bounds for Turbulent Transport, *Physical Review Letters*, 1989

Burgers' Equation, MHD equilibria

46. R Ryan, M Avellaneda, The One-Point Statistics of Viscous Burgers Turbulence Initialized with Gaussian Data, *Communications in Mathematical Physics*, 1999
47. M Avellaneda, E Weinan and R. Ryan, PDF for velocity and velocity gradients in Burgers' Turbulence, *Physics of Fluids*, Volume 7, Issue 12, 1995

48. M Avellaneda, E Weinan, Statistical properties of shocks in Burgers turbulence, *Communications in Mathematical Physics*, 1995
49. P Laurence, M Avellaneda , A Moffatt-Arnold formula for the mutual helicity of linked flux tubes, *Geophysical & Astrophysical Fluid Dynamics*, 1993
50. Laurence, M Avellaneda, Woltjer's variational principle, II: The case of unbounded domains *Geophysical & Astrophysical Fluid Dynamics*, 1993
51. P Laurence, M Avellaneda, On Woltjer's variational principle for force-free fields *Journal of Mathematical Physics*, 1991
52. M Avellaneda, Enhanced diffusivity and intercell transition layers in 2-D models of passive advection, *Journal of Mathematical Physics*, 1991

Flow in Porous Media

53. W Macevoy, M Avellaneda, Electro-osmotic Coupling: Incorporating Larger Surface Effects with a New Length Scale, *Journal of Colloid And Interface Science*, 1997
54. Achdou Y., M. Avellaneda; Influence of pore roughness and pore-size dispersion in estimating the permeability of a porous medium from electrical measurements, *Phys Fluids A* (1992)
55. Avellaneda, M., S.Torquato; Diffusion and reaction in heterogeneous media: Pore size distribution, relaxation times, and mean survival time, *Physics of Fluids A* 1991
56. S. Torquato and M. Avellaneda, Diffusion and Reaction in Heterogeneous Media: Pore Size Distribution, Relaxation Times, and Mean Survival Time, *Journal of Chemical Physics*, **95**, 6477 (1991).
57. S. Torquato and M. Avellaneda Cross-Property Relations for Transport in Porous Media: Rigorous Link Between Fluid Permeability, Electrical Conductivity, and Relaxation Times, in *Multiphase Transport in Porous Media*, American Society of Mechanical Engineers, 73 (1991).
58. R. Lipton, M. Avellaneda, Darcy's law for slow viscous flow past a stationary array of bubbles, *Proc. Royal Soc. Edinburgh*, 114A (1990),

Composites

59. Avellaneda M.; Berlyand L. V. Clouet J-F., Frequency dependent acoustics of composites with interfaces. *SIAM J. Applied Math*, 60:6, 2143-2181 (2000).
60. M Avellaneda, PJ Swart, Calculating the performance of 1–3 piezoelectric composites for hydrophone applications, *The Journal of the Acoustical Society of America*, 1998
61. M. Avellaneda, A. Cherkaev, L.Gibiansky, G.W.Milton, M. Rudelson. Complete characterization of possible isotropic effective tensors of polycrystals in planar elasticity (orthotropic monocrystal). *Journal of Mechanics and Physics of Solids* 44(7) 1179-1218, 1995
62. M Avellaneda, G Harshe, Magnetolectric Effect in Piezoelectric/Magnetostrictive Multilayer (2-2) Composites, *Journal of Intelligent Material Systems and Structures*, 1994
63. Swart, P. J. and Avellaneda, M., “The Role of Matrix Porosity and Poisson’s Ratio on the Design of High-Sensitivity Piezocomposite Transducers”, *J. Adaptive Materials and Structures*, 1994
64. M Avellaneda, PJ Swart, Effective moduli and electro-acoustic performance of epoxy-ceramic 1-3 piezocomposites, *Proceedings of SPIE*, 1993
65. T Olson, M Avellaneda, Effective moduli of granular and layered composites with piezoelectric constituents, *Proceedings of SPIE*, 1993
66. M Avellaneda, T Olson, Effective Medium Theories and Effective Electromechanical Coupling Factors for Piezoelectric Composites, *Journal of Intelligent Material Systems and Structures*, 1993
67. T Olson, M Avellaneda, Effective dielectric and elastic constants of piezoelectric polycrystals, *Journal of Applied Physics*, 1992
68. M Avellaneda, O Bruno, Effective conductivity and average polarizability of random polycrystals, *Journal of Mathematical Physics*, 1990
69. M Avellaneda, GW Milton, Optimal Bounds on the Effective Bulk Modulus of Polycrystals, *SIAM Journal on Applied Mathematics*, 1989

70. M Avellaneda, AV Cherkaev, KA Lurie, GW Milton, On the conductivity of polycrystals and a phase-interchange inequality, *Physica A*, 1989
71. M. Avellaneda, A. Cherkaev, K. Lurie, G. Milton. On the effective conductivity of polycrystals and a 3 dimensional phase-interchange inequality.- *J. Appl. Phys.*, 1988, 63, N.10, 4989-5003
72. M. Avellaneda, Optimal Bounds and Microgeometries for Elastic Two-Phase Composites
SIAM Journal on Applied Mathematics, Vol. 47, No. 6 (Dec., 1987)
73. Avellaneda, M. Iterated homogenization, differential effective medium theory and applications. *Comm. Pure Appl. Math.* **XL** 527—554, 1987

Partial Differential Equations & Homogenization Theory

74. S. Alama, M. Avellaneda, P. A. Deift and R. Hempel, On the existence of eigenvalues of a divergence form operator $A+B$ in a gap of A . *Asymptotic Anal.* 1994
75. M. Avellaneda, C. Bardos and J. Rauch, Contrôlabilité exacte, homogénéisation et localisation d'ondes dans un milieu non-homogène, *Asymptot. Anal.* 5 (1992)
76. M. Avellaneda, T. Y. Hou and G. Papanicolaou, Finite Difference Approximations for Partial Differential Equations with Rapidly Oscillating Coefficients, *M. Mathematical Modelling and Numerical Analysis*, **25**, 693-710 (1991).
77. M Avellaneda and FH Lin, Un théorème de Liouville pour des équations elliptiques à coefficients périodiques(A Liouville theorem for elliptic equations with periodic coefficients), *Comptes Rendus de l'Academie des Sciences de Paris*, 1989
78. M. Avellaneda and F. H. Lin, Homogenization of Poisson's kernel and applications to boundary control, *J. Math. Pures Appl.* 68 (1989)
79. M Avellaneda, FH Lin, L_p Bounds on singular integrals in homogenization, *Commun. Appl. Math*, 1991
80. M Avellaneda, FH Lin Compactness methods in the theory of homogenization II: Equations in non-divergence form, *Comm. Pure Appl. Math*, 1989
81. M Avellaneda, FH Lin Compactness methods in the theory of homogenization, *Comm. Pure Appl. Math*, 1988

82. Fonctions quasi-affines et minimization de $\int |\text{grad } u|^p$, *Comptes Rendus de l'Academie des Sciences de Paris*, 1988
83. M Avellaneda, FH Lin, Homogenization of elliptic problems with L_p boundary data *Applied Mathematics and Optimization*, 1987
84. M Avellaneda, FH Lin, Counterexamples related to high-frequency oscillation of Poisson's kernel, *Applied Mathematics and Optimization*, 1987

Ph. D. Dissertation

85. M Avellaneda, *Large Deviation Estimates and the Homological Behavior of Brownian Motion on Manifolds*, – Dissertation University of Minnesota, 1985.
Advisor: Naresh Jain

Doctoral Students

Tamara Olson: New York University 1991

Overall Properties of Granular Piezoelectrics: Bounds and Effective Medium Approximations

Christopher Apelian: New York University 1993

Anomalous Diffusion and Percolation Results for Transport in a Two Dimensional Random Field

Antonio Paras: New York University 1995

Non-linear Diffusion Equations in Mathematical Finance: A Study of Transaction Costs and Uncertain Volatility

Reade Ryan: New York University 1996

Large Deviation Analysis of Gaussian Fields and the Statistics of Burgers' Turbulence

Juan Porras: New York University 1997

Pricing and Hedging Volatility Risk in Interest-Rate Derivatives

Yingzi Zhu: New York University 1997

Three Essays in Mathematical Finance

Dominick Samperi: New York University 1998

Inverse Problems, Model Selection and Entropy in Derivative Security Pricing

Robert Buff: New York University 1999
Algorithms for Nonlinear Models in Computational Finance and Their Object-Oriented Implementation

Craig Friedman: New York University 1999
The Method of Multiple Probability Measures in Mathematical Finance: No Arbitrage Securities Markets, Cartright Claim Pricing, and Model Calibration

Lukasz Kruk: New York University 1999
Optimization Problems for Diffusion Processes: Some Aspects of Singular Stochastic Control and Minimum Relative Entropy Calibration

Joshua Newman: New York University, 1999
Model Calibration in Mathematical Finance

Michael Fisher: New York University 2003
Contributions to the Method of Entropy Calibration in Financial Modeling

Juyoung Lim: New York University 2003
Pricing and Hedging Index Options

Junyoep Park: New York University 2006
Dynamic Risk Factor Model for Correlation Matrices: From Random Matrix Theory to Econometrics

Eric Ben-Artzi: New York University 2006
Numerical Methods for Non-Linear Equations in Finance