Frédéric Abergel

Laboratory of Mathematics Applied to Systems
CentraleSupélec

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Current position Professeur des Universités (*Full Professor*)

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France

Research interests

Financial markets

Pricing and hedging of derivatives

Empirical properties of financial data

Partial differential equations

Education

1992	Habilitation à diriger des recherches en Sciences, Université Paris Sud
1986	Doctorat en Mathématiques, Université Paris Sud
1981-1985	École Normale Supérieure

Professional experience

02/2015 to 08/2015:	Visiting researcher, Laboratoire de Probabilités et Modélisation Aléatoire, CNRS et Université Paris 6 et Paris 7
05/2011 to date:	Director, Laboratory of Mathematics Applied to Systems, CentraleSupélec

10/2007 to date:	Professor, holder of the Chair of Quantitative Finance, CentraleSupélec
09/2005 to 09/2007:	Head of the equity, commodity and hybrid quantitative analytics group, Natixis CIB
04/2004 to 08/2005:	Head of the Paris quantitative analytics group, Barclays Capital
09/2001 to 03/2004:	Senior quantitative analyst, CAI Cheuvreux
03/1996 to 09/2001:	Consultant for the equity derivatives quantitative analytics group, BNP Paribas
01/1993 to 09/1998:	Chargé de recherches 1ère classe, CNRS and Université Paris XI
01/1989 to 01/1993:	Chargé de recherches 2ème classe, CNRS and Université Paris XI
08/1987 to 12/1988:	Assistant Professor, Department of Mathematics, the Pennsylvania State University
09/1985 to 07/1987:	Teaching assistant, Université Paris XI

Scientific responsibilities

Member of the organizing and scientific committees of the annual *Financial Risks International Forum*, Paris (since 2008)

Organizer of the annual Kolkata Econophysics conference (since 2010)

Organizer of the biennal conference *Market microstructure: confronting many viewpoints*, Paris (since 2010)

Organizer of the conference *Statistical modeling, financial data analysis and applications*, IVSLA, Venice, September 2013

Organizer of the conference *Mathematical modelling of complex systems*, École Centrale Paris, December 2013

PhD supervisions

PhD supervised since 2008: M. Anane, R. Chicheportiche, S. El Aoud, N. Huth, A. Jedidi, M. Lallouache, N. Millot, F. Pomponio, R. Tachet, R. Zaatour, B. Zheng

On-going PhD supervisions: A. Bel Hadj Ayed, C. Huré (starting 09/2015), X. Lu (starting 09/2015)

Editorial responsibilities

Scientific journals

Co-founder and managing editor of Market Microstructure and Liquidity
Managing editor of Quantitative Finance (since 01/2013)

Conference proceedings

F. Abergel, B. K. Chakrabarti, A. Chakraborti, A. Ghosh, H. Aoyama (editors), *Econophysics of agent-based models*, proceedings of the 8th Kolkata Econophysics conference, New economic windows, Springer, 2015

F. Abergel, M. Aiguier, P.-H. Cournède, G. Faÿ, P. Lafitte, proceedings of the 1st conference on *Mathematical modeling of complex systems*, ESAIM Proceedings and Surveys, volume 47, 2014,

F. Abergel, B. K. Chakrabarti, A. Chakraborti, A. Ghosh, H. Aoyama (editors), *Econophysics of agent-based models*, proceedings of the 7th Kolkata Econophysics conference, New economic windows, Springer, 2014

F. Abergel, B. K. Chakrabarti, A. Chakraborti, A. Ghosh (editors), *Systemic risk and network dynamics*, proceedings of the 6th Kolkata Econophysics conference, New economic windows, Springer, 2013

F. Abergel, J.-P. Bouchaud, T. Foucault, C. Lehalle, M. Rosenbaum (editors), proceedings of the 1st *Market Microstructure: Confronting Many Viewpoints* conference, Wiley Finance Series, 2012

F. Abergel, B. K. Chakrabarti, A. Chakraborti, M. Mitra (editors), *Econophysics of order-driven markets*, proceedings of the 5th Kolkata Econophysics conference, New economic windows, Springer, 2011

List of publications

Theses and memoirs

Mémoire d'habilitation à diriger des recherches, Université Paris Sud, 1992
Quelques problèmes non linéaires provenant de la Mécanique des fluides
Jury: C. Bardos, J. Bona, J. Douglas, jr, P.-L. Lions, J.-C. Saut, J. Smoller, V. A. Solonnikov, R. Temam

Thèse de doctorat, Université Paris Sud, 1986
Étude d'un problème de contrôle optimal convexe mal posé
Jury: C. Bardos, F. Mignot, R. Temam

Book chapters and review articles

A. Chakraborti, I. Muni Toke, M. Patriarca, F. Abergel, *Econophysics: empirical facts* Quantitative Finance, volume 11, issue 7, 2011, pp. 991-1012

A. Chakraborti, I. Muni Toke, M. Patriarca, F. Abergel, *Econophysics: agent-based models*, Quantitative Finance, volume 11, issue 7, 2011, pp. 1013-1041

Publications in peer-reviewed journals

1. Since 2008

S. El Aoud, F. Abergel, *A stochastic control approach for option market making,* to appear in Market Liquidity and Microstructure

F. Abergel, C.-A. Lehalle, M. Rosenbaum, *Understanding the stakes of high-frequency trading,* The Journal of Trading, volume 9, issue 4, 2014, 49-73

M. Lallouache, F. Abergel, *Tick size reduction and price clustering in a FX order book*, Physica A: Statistical Mechanics and its Applications, volume 416, 2014, pp 488-498

B. Zheng, F. Roueff, F. Abergel, *Ergodicity and scaling limit of a constrained multivariate Hawkes process*, SIAM J. Financial Mathematics, volume 5, 2014

N. Huth, F. Abergel, *High frequency lead/lag relationships - empirical facts*, Journal of Empirical Finance, volume 26, 2014, pp 41-58.

F. Abergel, A. Jedidi, *A mathematical approach to order book modelling*, International Journal of Theoretical and Applied Finance, volume 16, Issue 5, 2013, pp 1-40

B. Zheng, E. Moulines, F. Abergel, *Price jump prediction in a limit order book*, Journal of Mathematical Finance, Volume 3, Issue 2, 2013, pp 242-255

F. Abergel, J.-M. Rakotoson, *Gradient blow-up in Zygmund spaces for the very weak solution of linear elliptic equations*, Discrete Cont. Dynamical Systems, Serie A, volume 33, issue 5, 2013, pp1809 – 1818

F. Pomponio, F. Abergel, *Multiple-limit trades: empirical facts and application to lead-lag measures*, Quantitative Finance, volume 13, issue 5, 2013, pp 783-793

F. Abergel, M. Politi, *Optimizing a basket against the efficient market hypothesis,* Quantitative Finance, volume 13, issue 1, 2013, pp 13-23

F. Abergel, J.-H. Bailly, *Stationary free surface viscous flows without surface tension in three dimensions,* Differential and Integral Equations, volume 25, issue 9/10, 2012, pp 801-820.

R. Zaatour, F. Abergel, *What drives option prices?,* Journal of Trading, volume. 7, issue 3, 2012, pp 12-28

N. Huth, F. Abergel, *The times change: multivariate subordination, empirical facts,* Quantitative Finance, volume 12, issue 1, 2012, pp 1-10

F. Abergel, N. Millot, *Local risk minimization for hedging contingent claims in incomplete markets,* SIAM J. Financial Math, volume 2, 2011, pp 342-356

F. Abergel, R. Tachet, *A nonlinear partial integrodifferential equation from mathematical finance,* Discrete Cont. Dynamical Systems, Serie A, volume 27, issue 3, 2010, pp 907-917

2. Before 1999

F. Abergel, J.-H. Bailly, *Higher order symmetrizers and application to an unusual transport equation,* Comm. Partial Diff. Equations, vol. 24, 9-10, 1999, pp. 1593-1610

F. Abergel, *Well-posedness for a Cauchy problem associated to time-dependent free boundaries with nonlocal leading terms,* Comm. Partial Diff. Equations, vol. 21, 9-10, 1996, pp. 1307-1319

F. Abergel, C. Dupaix, *Existence of smooth, stationary interfaces for Marangoni-type flows*, Non Linear Analysis: Theory, Methods and Applications, volume 27, 11, 1996, pp 1329-1350

F. Abergel, A. Decarreau, J.-M. Rakotoson, *Study of nonlinear elliptic-parabolic equation with measures as data: existence, regularity and behaviour near a singularity*, Non Linear Analysis: Theory, Methods and Applications, volume 26, 11, 1996, pp 1869-1887

F. Abergel, J. Mossino, *Caractérisation du problème de Muskat multidimensionnel et existence de solutions régulières*, C.R.A.S Série I, 319, 1, 1994, pp 35-40

F. Abergel, D. Hilhorst, F. Issard-Roch, *On a dissolution-growth problem with surface tension in the neighbourhood of a stationary solution,* SIAM J. MATH. ANAL. Vol. 24, No. 2, 1993, pp. 299-316

F. Abergel, *A geometric approach to the study of stationary free surface flows for viscous liquids,* Proc. Royal Soc. Edinburgh, vol. 123, 2, 1993, pp. 209-229

F. Abergel, E. Casas, *Some optimal control problems of multistate equations appearing in fluid mechanics*, RAIRO – M2AN, volume 27, 1993, pp 223-247

F. Abergel, J. L. Bona, *A mathematical theory for viscous, free-surface flows over a perturbed plane*, Arch. Rational Mech. Anal., 118, 1992, pp 71-93

F. Abergel, *Dimension of invariant sets for Lipschitz continuous semigroups*, Indiana Univ. Math. J., vol**.** 40, 1991, pp. 1029-1039

F. Abergel, *existence and finite dimensionality of the global attractor for evolution equations on unbounded domains*, J. Diff. Equations, vol. 83, 1, 1990, pp. 85-108

F. Abergel, R. Temam, *On some control problems in fluid mechanics*, Theoret. Comput. Fluid Dynamics, vol. 1, 1990, pp. 303-325

F. Abergel, *Attractor for a Navier-Stokes flow in an unbounded domain,* RAIRO, M2AN vol. 23, 3, 1989, pp. 359-370

F. Abergel, R. Temam, *Duality methods for the boundary control of some evolution equations,* Operator Theory: Advances and Applications, 41, 1989, pp 1-12

F. Abergel, R. Temam, *Optimality conditions for some nonqualified problems of distributed control,* SIAM J. Control Optim 27 (1), 1989, pp 1-12

F. Abergel, *A non-well-posed problem in convex optimal control*, Appl. Math. Optim., vol. 17, 1, 1988, pp. 133-175

F. Abergel, *Conditions d'optimalité pour un problème de contrôle mal posé I. Un problème d'optimisation convexe non coercif*, C.R.A.S Série I, 303, 6, 1986, pp 227-230 et *II. Dualité et pénalisation*, C.R.A.S Série I, 303, 7, 1986 pp 295-298

Publications in conference proceedings (since 2008)

S. El Aoud, F. Abergel, *Calibration of a stock's beta using option prices,* Proceedings of the 8th Kolkata Econophysics conference, Springer, New economic window, 2015

M. Anane, F. Abergel, *Empirical evidence of market inefficiency: predicting single-stock returns*, Proceedings of the 8th Kolkata Econophysics conference, Springer, New economic window, 2015

F. Abergel, N. Huth, *Some recent results on high frequency correlation*, Proceedings of the 1st *Market microstructure: confronting many viewpoints* conference, Wiley Finance Series, 2013

F. Pomponio, F. Abergel, *Trade-throughs: empirical facts and application to lead-lag measures*, Proceedings of the 5th Kolkata Econophysics conference, Springer, New economic window, 2011

F. Abergel, A. Jedidi, *A mathematical approach to order book modelling*, Proceedings of the 5th Kolkata Econophysics conference, Springer, New economic window, 2011

L. Foata, M. Vidhamali, F. Abergel, *Multi-agent order book simulation: mono- and multi-asset high frequency market making simulations*, Proceedings of the 5th Kolkata Econophysics conference, Springer, New economic window, 2011

N. Huth, F. Abergel, *High frequency correlation modelling*, Proceedings of the 5th Kolkata Econophysics conference, Springer, New economic window, 2011

F. Abergel, *Credit risk in the pricing and hedging of derivatives*, Proceedings of the 1st Financial Risks International Forum, C. Gouriéroux, M. Jeanblanc (editors), Economica, 2009

Conferences and seminars

Invited conferences (since 2008)

Mathematical properties of limit order books modelled by Hawkes processes, The Mathematics of High Frequency Financial Markets: Limit Order Books, Frictions, Optimal Execution and Program Trading, IPAM, UCLA, 04/2015

Liquidity costs and market impact for derivatives, International conference on quantitative finance, insurance and risk management – a tribute to Nicole El Karoui and Michel Crouhy for their 70th birthday, Marrakech, 10/2014

Modeling liquidity costs and market impact for derivatives, SMAI-SIAM international conference on financial mathematics, Paris, 06/2014

Some structure properties of the free surface operator for viscous fluids, 10th AIMS conference on dynamical systems, differential equations and applications, Madrid, 07/2014

The evidence of lead-lag relationships in high frequency data, 8th Kolkata Econophysics conference, 03/2014

How to measure lead-lag from high frequency data?, Workshop on statistics for stochastic processes and analysis of high frequency data, Paris, 12/2013

Liquidity costs and market impact for derivatives, International conference on statistical modeling, financial data analysis and applications, Venice, 09/2013

Stationary free surface flows without surface tension, 9th AIMS conference on dynamical systems, differential equations and applications, Orlando, 07/2012

Mathematical modelling of limit order books, Quantitative methods in finance, Cairns, 06/2012

Mathematical modelling of limit order books, Quantitative and statistical finance, Paris, 03/2012

Systemic risk and dynamical systems: New wine in an old jar?, Joint ECB-NY FED conference on alternative approaches to modelling systemic risk, 06/2011

Some empirical and mathematical properties of limit order books, School and workshop on market microstructure: design, efficiency and statistical regularities, ICTP, Trieste, 03/2011

Empirical properties and mathematical models of limit order books, First workshop on quantitative finance and economics, International Christian University of Tokyo, Japan, 02/2011

Some mathematical properties of markovian order books, Modelling and managing financial risks, Paris, 01/2011

Intraday correlation trading, 3rd Financial risks international forum, Paris, 03/2010

A mathematical approach to order book modelling, 5th Kolkata Econophysics conference, Kolkata, 03/2010

Risk measurement and risk management of derivative products, Colloquium on financial risk, market complexity and regulation, Collegium Budapest, 10/2009

<u>Contributed communications</u> (since 2008)

Derivative hedging with liquidity costs and market impact, Frontiers in financial mathematics conference, Dublin, 06/2013

Transaction costs, market impact and derivative hedging, IMA conference on Mathematics in finance, Heriot-Watt University, Edinburgh, 04/2013

Multidimensional trade time: a new approach to correlation modelling, Quantitative methods in finance, Sydney, 12/2009

<u>Invited seminar talks</u> (since 2008)

Hawkes-process driven limit order books, Groupe de travail finance mathématique, probabilités numériques, statistique des processus, LPMA, 03/2015

Pricing and hedging derivatives with liquidity costs and market impact, Financial Mathematics seminar, ETH Zürich, 10/2013

Derivative hedging with liquidity costs and market impact, Groupe de travail Mathématiques financières, probabilités numériques, Université Paris 6, 04/2013

Empirical and mathematical properties of limit order books, Financial Mathematics seminar, Uppsala university, 10/2012

Modélisation mathématique des marchés à carnet d'ordres, Laboratoire de Mathématiques et Applications, Université de Poitiers, 04/2011

Quelques modèles de marché markoviens, séminaire Méthodes stochastiques et finance, Université de Marne La Vallée, 10/2010

Some mathematical properties of markovian market models, séminaire Fiesta, École Polytechnique, 10/2009

Agent-based models and continuous time finance, EM Lyon, 02/2009

Optimal control and hedging of derivative products, Petit déjeuner de la finance, Maison des polytechniciens, 02/2008

<u>Teaching experience</u>

<u>Since 2008</u>, I have been teaching, and in charge of, several classes at the undergraduate and graduate levels at École Centrale Paris, on financial mathematics and quantitative finance:

- Financial risks modelling (introductory course)
- Model calibration for derivatives (advanced course)
- High frequency data and market microstructure (advanced course)

I also taught a post-graduate course on limit order books at the University of Tokyo (01/2015)

<u>Between 1987 and 1998</u>, I have taught various classes at the undergraduate, graduate and post-graduate levels in Mathematics (complex variable, calculus, continuum mechanics, infinite dimensional dynamical systems…) at the Université d'Orsay and The Pennsylvania State University.