MELEARD Sylvie, Professor in Applied Maths,
Vice-Chair of the Applied Mathematics Department, Ecole Polytechnique
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1 Education and professional experience

1977 -1981 : Ecole Normale Supérieure de Fontenay-Aux-Roses.
1981 : Agregation of Mathematics.
1984 : PhD thesis (advisor N. El Karoui, Univ. Paris 6).
1984 - 1989 : Maître-Assistante, University of Le Mans.
1989 - 1992 : Maître de Conférences, University Pierre et Marie Curie.
1991 : Habilitation à diriger des recherches (UPMC).
1992- 2006 : Professor, University Paris-Ouest, Nanterre.
2006 - : Professor, Ecole Polytechnique.
2010 - 2014 : Chair of the Applied Maths Department.
2011- : Administrator of the Ecole polytechnique.
2014- : Vice-Chair of the Applied Maths Department

Honors and Awards :
Chevalier de la légion d'honneur.
"La Recherche" Award, 2013.
Alan Tayler lecture, ECMI 2014.
Invited Speaker to the 7th European Congress of Mathematics (Berlin 2016).

Research Interests : Probability and Stochastic Processes

  Interacting particle systems, stochastic particle methods

  Probabilistic interpretation of nonlinear partial differential equations

  Measure–valued processes

  Quasi-stationary distributions

Random models for adaptive evolution

Mathematical modeling for ecology and biodiversity.

Edition service

2000 - 2006 : Associate Editor for *Annals of Probability*.

2003 - 2009, 2012-2015 : Associate Editor for *Stochast. Process. and Appl.*.

2008 - : Associate Editor for *Mathematics in Action*.

2012 - : Associate Editor for *SMAI textbooks*

2012 - 2015 : Associate Editor for *Bernoulli*

2016 - : Associate Editor for *Annals of Applied Probability*.

Main Scientific Animation

Coordinator of the Research project ANR MANEGE (Random Modeling in Ecology, Genetics, Evolution) - 2010-2013.

Director of the research group PEIPS (Population Evolution and Interacting Particle Systems) in CMAP, Ecole Polytechnique.

Head of the Chair "Mathematical Modeling and Biodiversity", Veolia , Ecole Polytechnique, Muséum national d'Histoire naturelle. From 2009.

PhD students

Pierre-Luc Morien, PhD 1996.

Benjamin Jourdain, PhD 1998.

Nicolas Fournier, PhD 1999.

Hélène Guérin, PhD 2002.

Joaquin Fontbona, PhD 2004.

Nicolas Champagnat, PhD 2004.

Chi Viet Tran, PhD 2006.

Jose-Luis Garmendia (co-direction with M.E. Caballero, UNAM), PhD 2009.

Denis Villemonais, PhD 2011.

Florent Barret (co-direction with A. Bovier, Bonn), PhD 2012.

Camille Coron, PhD 2013.

Charline Smadi Lasserre, PhD 2015.

Manon Costa, PhD 2015.

Hélène Leman, PhD2016.

Tristan Roget, in progress

Publications

Application du calcul stochastique à l'étude des processus de Markov réguliers sur [0, 1], Stochastics Stochastics Rep. 19, no. 1+2, (1986), 41-82.

A propagation of chaos result for a system of particles with moderate interaction, with S. Roelly, Stochastic Process. Appl. 26, no. 2, (1987), 317-332.

Systèmes de particules et mesures martingales : un théorème de propagation du chaos, with S. Roelly, Séminaire de Probabilités 22, L.N. 1321, Springer, (1988), 438-448.

A generalized equation for a continuous measure branching process, with S. Roelly, Proceedings Trento 1988 (Stochastic Partial Differential Equations and Applications II), L.N. 1390 (1989), 171-185, Springer.

Some stochastic models of interacting diffusion processes and the associated propagation of chaos, Proceedings, Stochastic Modelling in Biology, Heidelberg (1990), 107-125, World Scientific.

Martingale measures and stochastic calculus, with N. El Karoui, Probab. Theory Related Fields 84 (1990), 83-101.

Discontinuous measure-valued branching processes and generalized stochastic equations, with S. Roelly, Math. Nachr. 154 (1991), 141-156.

Interacting measure branching processes, with S. Roelly, Proceedings Stochastic partial differential equations, Pitman research notes in Mathematics 268 (1992), 246-256, Longman Scientific and technical.

An ergodic result for critical spatial branching processes, with S. Roelly, Proceedings Stochastic analysis and Related topics (1992), 333-342, Birkhäuser.

Representation and approximation of martingale measures, Proceedings IFIP W 7/1 International Conference University North carolina at Charlotte (1992), 188-199, L.N. in Control and Information Sciences, Springer.

Propagation of chaos for a fully connected loss network with alternate routing, with C. Graham, Stochastic Process. Appl. 44, no. 1 (1993), 159-180.

Interacting measure branching processes. Some bounds for the support, with S. Roelly, Stochastics Stochastic Rep. 44, no. 1+2 (1993), 103-121.

Sur les convergences étroite ou vague de processus à valeurs mesures, with S. Roelly, CRAS de l'Acad. des Sci. Paris, t. 317, Série I (1993), 785-788.

Fluctuations for a completely connected loss network, with C. Graham, Stochastic Process. Appl. 53 (1994), 97-115.

Chaos hypothesis for a system interacting through shared ressources, with C. Graham, Probab. Theory Related Fields 100 (1994), 157-173.

Dynamic asymptotic results for a generalized star-shaped loss network, with C. Graham, Ann. Appl. Probab. 5, no. 3 (1995), 666-680.

Asymptotic behaviour of some interacting particle systems McKean-Vlasov and Boltzmann models, C.I.M.E. Lecture Notes, Probabilistic models for nonlinear partial differential equations May 1995, L.N. in Math. 1627 (1996), 42-95, Springer.

Convergence rate on path space for stochastic particle approximations to the Boltzmann equation, with C. Graham, Proceedings ICIAM 95, Numerical Analysis, Ed. G. Alefeld, Special issue ZAMM (1996).

Stochastic particle approximations for generalized Boltzmann models and convergence estimates, with C. Graham, Ann. Probab. 25, no. 1 (1997), 115-132.

A Hilbertian approach for fluctuations on the McKean-Vlasov model, with B. Fernandez, Stochastic Process. Appl. 71 (1997), 33-53.

An upperbound of large deviations for a generalized star-shaped loss network, with C. Graham, Markov Process. Related Fields 3, no. 2 (1997), 199-223.

Stochastic approximations of the solution of a full Boltzmann equation for small initial data, ESAIM http ://www.emath.fr/ps/., Vol. 2 (1998), 23-40.

Convergence of the fluctuations for interacting diffusions with jumps associated with Boltzmann equations, Stochastics Stochastic Rep. 63, no. 3+4 (1998), 195-225.

A large deviations principle for a large star-shaped loss network with links of capacity one, with C. Graham, Markov Process. Related Fields 3, no. 4 (1998), 475-492.

Probabilistic interpretation and approximations os some Boltzmann equations, Lecture Notes of a course in the 5th Symposium in Probability and Stochastic Processes, Aportaciones Matematicas, Modelos Estocaticos 14, Sociedad Matematica Mexicana (1998), 1-64.

Propagation of chaos and fluctuations for a moderate model with smooth initial data, with B. Joudain, Ann. Inst. Henri Poincaré Probab. 34, no. 6 (1998), 727-766.

Probabilistic interpretation and numerical approximation of a Kac equation without cut-off, with C. Graham and L. Desvillettes, Stochastic Process. Appl. 84, no. 1 (1999), 115-135.

Existence and regularity of a solution of a Kac equation without cutoff using Malliavin calculus, with C. Graham, Comm. Math. Phys. 205, no. 3 (1999), 551-570.

Asymtotic behaviour for interacting diffusion processes with space-time random birth, with B. Fernandez, Bernoulli 6, no. 2 (2000), 1-21.

The integrand term in the martingale representation theorem, stability results and a Clarke Ocone formula for Markov processes, with Jean Jacod and Philip Protter, Ann. Probab. 28, no. 4, 1747-1780, (2000).

A trajectorial proof of the vortex method for the 2d Navier Stokes equation, Ann. Appl. Probab. 10, no. 4, 1197-1211, (2000).

Monte-Carlo approximations and fluctuations for 2D Boltzmann equations without cutoff, with N. Fournier, Inhomogeneous random systems (Cergy-Pontoise 2000), Markov Process. Related Fields 7 (2001), 159-191.

A Markov process associated with a Boltzmann equation without cutoff for non Maxwell molecules, with N. Fournier, J. Statist. Phys. 104, no. 1-2 (2001), 359-385.

Monte-Carlo approximations for 2D homogeneous Boltzmann equations without cutoff for non Maxwell molecules, with N. Fournier. Monte-Carlo and probabilistic methods for partial differential equations (Monte-Carlo 2000), Monte-Carlo Methods Appl. 7, no. 1-2 (2001), 177-192.

Monte-Carlo approximations of the solution of 2d Navier-stokes equations with finite measure initial data, P.T.R.F. 121 (2001), no 3, 367-388.

Probabilistic tools and Monte-Carlo approximations for some Boltzmann equations, with C. Graham, CEMRACS Lecture Notes, July 1999, ESAIM-Proceedings Vol. 10 - CEMRACS, 77-126 (2001).

A stochastic particle numerical method for 3D Boltzmann equations without cutoff, with N. Fournier, Math. Comp. 71, no. 238 (2002), 583-604.

A weak criterion of absolute continuity for jump processes : application to the Boltzmann equations, with N. Fournier, Bernoulli 8, no. 4 (2002), 537-558.

Convergence from Boltzmann to Landau with soft potential and particle approximations, with H. Guérin, J. Statist. Phys. 111, no. 3/4 (2003), 931-966.

Probabilistic Interpretation and Particle Method for Vortex equations with Neumann's boundary condition, with B. Jourdain, Proceedings of the Edinburgh Mathematical Society 47 (2004), 597-624.

Microscopic probabilistic description of a locally regulated population and macroscopic approximations, with N. Fournier, The Annals of Applied Probability 14, no 4 (2004), 1880-1919.

Stochastic particle approximations for two-dimensional Navier-Stokes equations, Dynamics and Randomness II, A. Maass, S. Martinez and J. San Martin eds., Nonlinear Phenomena and Complex Systems, pp. 147-198, Kluwer Academic Publishers (2004).

The approximate Euler method for Lévy driven stochastic differential equations, with J. Jacod, T. Kurz and P. Protter, Annales de l'IHP, Probabilités et statistiques 41, 523-558, (2005).

A probabilistic approach for nonlinear equations involving the fractional Laplacian and a singular operator, with B. Jourdain abd W. Woyczynski, Potential Analysis 23, no 1 (2005), 55-81.

Probabilistic approximation and inviscid limits for 1-D fractional conservation laws, with B. Jourdain and W. Woyczynski, Bernoulli 11 no 4 (2005), 689-714.

Unifying evolutionary dynamics : from individual stochastic processes to macroscopic models, with N. Champagnat and R. Ferrière, Theoretical Population Biology 69 (2006) 297–321.

Estimates for the density of a nonlinear Landau process, with H. Guérin and E. Nualart, J. Funct. Anal. 238 (2006) 649–677.

Invasion and adaptive evolution for individual-based spatially structured populations, with N. Champagnat, J. Math. Biology 55 (2007) 147–188.

A random space-time birth particle method for 2d vortex equations with L^1-external field, with J. Fontbona , Math. Comp. 77 (2008), no. 263, 1525–1558.

Individual-based probabilistic models of adaptive evolution and various scaling approximations, with N. Champagnat and R. Ferrière, Progress in Probability, Vol. 59 (2007), 75–113, Birhaäuser Verlag Basel.

Nonlinear SDEs driven by Lévy processes and related PDEs, with B. Jourdain and W. Woyczynski, Alea 4 (2008), 1–29.

From individual stochastic processes to macroscopic models in adaptive evolution, avec N. Champagnat et R. Ferrière, Stochastic Models (2008), 24 No 1, 2–44.

Measurability of optimal transportation and convergence rate for Landau type interacting particle systems, with J. Fontbona and H. Guérin, Probab. Theory Related Fields 143 (2009), no. 3-4, 329–351.

Trait substitution sequence process and canonical equation for age-structured populations, with C. Viet Tran, . J. Math. Biol. 58 (2009), no. 6, 881–921.

Quasi-stationarity distributions and diffusion models in population dynamics, with P. Cattiaux, P. Collet, A. Lambert, S. Martinez, J. San Martin, Ann. Probab. 37 (2009), no. 5, 1926–1969.

Competitive or weak cooperative stochastic Lotka-Volterra systems conditioned on non-extinction, with P. Cattiaux, J. Math. Biology 6 (2010), 797–829.

Measurability of optimal transportation and strong coupling of martingale measures, with J. Fontbona et H. Guérin, Electron. C. Probab. 15 (2010), 124–133.

Uniform estimates for metastable transition times in a coupled bistable system, with F. Barret et A. Bovier, Electron. J. Probab. 15 (2010), 323–345.

Random Modeling of Adaptive Dynamics and Evolutionary Branching, The mathematics of Darwin's legacy, F. Chalub J.F. Rodrigues eds, Birhauser (2011).

Polymorphic evolution sequence and evolutionary branching, with N. Champagnat, Probab. Theory Related Fields, Volume 151, Issue 1 (2011), 45–94.

Quasi-stationarity distributions for structured birth and death process with mutations, with P. Collet, S. Martinez, J. San Martin, Probab. Theory Related Fields, Volume 151, Issue 1 (2011), Page 191–231.

Slow and fast scales for superprocess limits of age-structure populations, with C.V. Tran, Stoch Process. and Appl., 122 : 250–276 .

Lévy flights in evolutionary ecology, with B. Jourdain and W. Woyczynski, J. Math. Biol. 65 (2012), no. 4, 677–707.

Nonlinear historical superprocess approximations for population models with past dependence, with C.V. Tran. Electron. J. Probab., 17 (2012), 1–32.

Quasi-stationary distributions and population processes, with D. Villemonais. Probability Surveys, Vol. 9 (2012) 340–410.

A rigorous model study of the adaptative dynamics of Mendelian diploids, with P. Collet and J.A.J. Metz, J. Math. Biol., Volume 67, Issue 3 (2013), Page 569–607.

Stochastic models for a chemostat and long time behavior, with P. Collet, S. Martinez, J. San Martin, Adv. in Appl. Probab. 45 (3), (2013), 822-836.

Quantifying the mutational meltdown in diploid populations, with Camille Coron, Emmanuelle Porcher, Alexandre Robert, The American Naturalist, Vol. 181, No. 5 (Mai 2013), pp. 623–636.

Evolutive two-level population process and large population approximations, with S. Roelly, Annals of the University of Bucharest (mathematical series) 4 (LXII) (2013), 37–70.

Adaptation in a stochastic multi-resources chemostat model, with Nicolas Champagnat and Pierre-Emmanuel Jabin. J. Math. Pures Appl. (9) 101 (2014), no. 6, 755–788.

Non local Lotka-Volterra system with cross-diffusion in an heterogeneous medium, with Joaquin Fontbona. J. Math. Biol. 70 (2015), no. 4, 829–854.

Singular limits for reaction-diffusion equations with fractional Laplacian and local or nonlocal nonlinearity, with Sepideh Mirrahimi. Comm. Partial Differential Equations 40 (2015), no. 5, 957–993.

Influence of a spatial structure on the long time behavior of a competitive Lotka-Volterra type system, with Hélène Leman and Sepideh Mirrahimi. Disc. Cont. Dyn. Syst. - B 20 (2) (2015), 469-493.

Stochastic dynamics of adaptive trait and neutral marker driven by eco-evolutionary feedbacks, with Sylvain Billiard, Régis Ferrière and Chi Viet Tran. J. Math. Biol. 71 (2015), no. 5, 1211–1242.

Stochastic models for structured populations. Scaling limits and long time behavior, with Vincent Bansaye. Mathematical Biosciences Institute Lecture Series. Stochastics in Biological Systems, 1.4. Springer, Cham ; MBI Mathematical Biosciences Institute, Ohio State University, Columbus, OH, 2015.

Sharp asymptotics for the quasi-stationary distribution of birth-and-death processes, with Jean-René Chazottes and Pierre Collet. Probab. Theory Related Fields. 164 (2016), no. 1-2, 285Ð332.

Stochastic eco-evolutionary model of a prey-predator community, with Manon Costa , Céline Hauzy, Nicolas Loeuille. J. Math. Biol. J. Math. Biol. 72 (2016), no. 3, 573Ð622.

1.1 Pedagogical Publications

Aléatoire : Introduction à la théorie et au calcul des probabilités, Editions de l'Ecole Polytechnique, Ellipses, (2010).

Les Bases de l'Analyse, tomes 1 et 2, with J.Y. Chevalier, B. Ozerée et O. Salon, Dunod (1990,1991).

Ecrit du CAPES, Analyse et Probabilités, with C. Piquet, Masson (1992).

Nos 20 sujets préférés, CAPES de Mathématiques, with F. Bories-Longuet, A. Descomps-Guilloux, P. Jarraud, C. Piquet, Dunod, (2000).

"Encyclopédie des Techniques de l'Ingénieur" :
Présentation des probabilités, AF164 "Techniques de l'ingénieur", (2001).
Résumé de la théorie de la mesure et intégration, AF165 "Techniques de l'ingénieur", (2002).
Probabilités, Concepts fondamentaux, AF166 "Techniques de l'ingénieur", (2002).
Mouvement brownien et calcul stochastique, "Techniques de l'ingénieur", (2003).

Approche probabiliste pour l'étude d'équations aux dérivées partielles non linéaires issues de la mécanique des fluides, MATAPLI (2001).

Les différentes échelles de temps de l'évolution, with Vincent Bansaye and Amandine Veber, MATAPLI 100 (2013).

Grants

1. 2004–2006 ACI Populations Structurées, (dir. Sylvie Méléard).

2. 2007–2009 ANR Modèles Aléatoires de l'Évolution du Vivant (MAEV) (dir. E. Pardoux).

3. 2007–2009, 2010–2013 ECOS Conicyt C05E02 (dir. F. Comets).

4. 2010–2013 ANR MANEGE - Random Modeling in Ecology, Genetics, Evolution (dir. S. Méléard)

5. 2009–2020 Chair "Mathematical Modeling and Biodiversity", Veolia, Ecole Polytechnique, Muséum national d'Histoire naturelle (dir. S. Méléard).