


PERSONAL INFORMATION

Marco Fuhrman


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Date of birth 4 August 1964 | **Nationality** Italian

POSITION

Full Professor
Probability and Mathematical Statistics

WORK EXPERIENCE

2016 – Present

Full Professor

Probability and Mathematical Statistics (SSD MAT/06)
Università degli studi di Milano.

2002–2016

Full Professor

Probability and Mathematical Statistics (SSD MAT/06)
Politecnico di Milano.

1998–2002

Associate Professor

Probability and Mathematical Statistics (SSD MAT/06)
Politecnico di Milano.

1990–1998

Assistant Professor (Ricercatore)

Mathematical Analysis (gruppo 90, later A02A).
Politecnico di Milano.

VISITING POSITIONS

1994

Visiting fellow

Polish Academy of Sciences in Warszawa (6 months)

1995

Visiting fellow

Universität Bielefeld (2 months).

2004

Professeur invité

Université de Rennes 1 (2 weeks).

2005

Professeur invité

Université de Rennes 1 (2 weeks).

2011

Professeur invité

Université de Rennes 1 (2 weeks).

2013

Professeur invité

Université Paris Diderot (2 weeks).

2015 **Chercheur étranger de haut niveau**

Université du Maine, Le Mans (1 week).

EDUCATION AND TRAINING

1993 **PhD in Mathematics**

PhD thesis supervisor: Prof. Brunello Terreni (co-advisor: Prof. Giuseppe Da Prato).
Università degli Studi di Milano, Italy

1988 **Master of Science in Electronical Engineering**

Politecnico di Milano. Degree: 100/100 *cum laude*. Master thesis supervisor: Prof. Giovanni Prouse.

PERSONAL SKILLS

Mother tongue Italian

Other languages

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	C1	C1	C1
French	C2	C2	C2	C2	C2

Levels: A1 and A2: Basic user – B1 and B2: Independent user – C1 and C2: Proficient user
[Common European Framework of Reference for Languages](#)

Digital competences

	SELF-ASSESSMENT				
	Information Processing	Communication	Content creation	Safety	Problem solving
	Basic user	Independent user	Independent user	Basic user	Independent user

[Digital competences - Self-assessment grid](#)

Computer skills – independent user of e-mail programs and internet browsers
– good command of office suite (word processor, spread sheet, presentation software)
– good command of mathematical writing suite (LaTeX)

Driving licence B

ADDITIONAL INFORMATION

Full CV Full information on the following topics is available at my web site
<https://sites.google.com/site/marcofuhrman/>
where a complete list of publications, conferences, activities etc. is given.

Research interests I started my research activity in spectral theory of operators, semigroups of linear operators and applications to evolution equations. I have then addressed several issues in stochastic analysis and stochastic evolution equations, including well-posedness, regularity, filtering, Malliavin calculus, Markov transition semigroups, applications to stochastic partial differential equations. Recently I am carrying out research in stochastic optimal control and backward stochastic differential equations (BSDEs), studying applications to controlled stochastic partial differential equations, partial differential equations on abstract spaces, stochastic systems described by multivariate point processes.

Bibliometry In March 2023, on Mathscinet: Total Publications: 57. Total Related Publications: 2. Total Citations: 682. *h*-index: 15.

Publications (since 2015)

1. Fuhrman, M., Morlais, M.-A.
Optimal switching problems with an infinite set of modes: An approach by randomization and constrained backward SDEs.
Stochastic Processes and their Applications 130 (2020), no. 5, 3120–3153.
2. Ugolini, S., Fuhrman, M., Mastrogioacomo, E., Morando, P., Rüdiger, B. (editors)
Proceedings of the Random Transformations and Invariance in Stochastic Dynamics Conference, Verona, Italy, March 25–29, 2019.
Springer Proceedings in Mathematics & Statistics, 378. Springer, Cham, 2021. xiv+265 pp.
3. Bandini, E., Cosso, A., Fuhrman, M., Pham, H.
Randomized filtering and Bellman equation in Wasserstein space for partial observation control problem.
Stochastic Processes and their Applications 129 (2017), no. 2, 674–711.
4. Confortola, F., Cosso, A., Fuhrman, M.
Backward SDEs and infinite horizon stochastic optimal control.
ESAIM. Control, Optimisation and Calculus of Variations 25 (2019), 31, 30pp.
5. Bandini, E., Cosso, A., Fuhrman, M., Pham, H.
Backward SDEs for optimal control of partially observed path-dependent stochastic systems: a control randomization approach.
The Annals of Applied Probability 28 (2018), no. 3, 1634–1678.
6. Confortola, F., Fuhrman, M., Guatteri, G., Tessitore, G.
Linear-quadratic optimal control under non-Markovian switching.
Stochastic Analysis and Applications 36 (2018), no. 1, 166–180.
7. Fuhrman, M., Hu, Y., Tessitore, G.
Stochastic maximum principle for optimal control of partial differential equations driven by white noise.
Stochastics and Partial Differential Equations: Analysis and Computations 6 (2018), no. 2, 255–285.
8. Bandini, E., Fuhrman, M.
Constrained BSDEs representation of the value function in optimal control of pure jump Markov processes.
Stochastic Processes and their Applications 127 (2017), no. 5, 1441–1474.
9. Fuhrman, M., Masiero, F., Tessitore, G.
Reflected BSDEs, optimal control and stopping for infinite-dimensional systems.
ESAIM. Control, Optimisation and Calculus of Variations 23 (2017), no. 4, 1419–1445.
10. Fuhrman, M., Tessitore, G.
HJB Equations Through Backward Stochastic Differential Equations.
Chapter 6 (pp. 685–781) in the book:
Fabbri, G., Gozzi, F., Swiech, A.
Stochastic optimal control in infinite dimension. Dynamic programming and HJB equations. With a contribution by Marco Fuhrman and Gianmario Tessitore.
Probability Theory and Stochastic Modelling, 82. Springer, Cham, 2017. xxiii+916 pp.
11. Confortola, F., Fuhrman, M., Jacod, J.
Backward stochastic differential equations driven by a marked point process: an elementary approach, with an application to optimal control.
The Annals of Applied Probability 26 (2016), no. 3, 1743–1773.
12. Cosso, A., Fuhrman, M., Pham, H.
Long time asymptotics for fully nonlinear Bellman equations: a Backward SDE approach.
Stochastic Processes and their Applications 126 (2016), no. 7, 1932–1973.
13. Fuhrman, M., Orrieri, C.
Stochastic maximum principle for optimal control of a class of nonlinear SPDEs with dissipative drift.
SIAM Journal on Control and Optimization 54 (2016), no. 1, 341–371.
14. Fuhrman, M., Pham, H., Zeni, F.
Representation of non-Markovian optimal stopping problems by constrained BSDEs with a single jump.
Electronic Communications in Probability 21 (2016), paper no. 3, 7 pp.
15. Fuhrman, M., Pham, H.
Randomized and backward SDE representation for optimal control of non-Markovian SDEs.
The Annals of Applied Probability 25 (2015), no. 4, 2134–2167.

Academic activity

Member of the INDAM-GNAMPA (INDAM is an Italian national mathematical institute - Gruppo Nazionale Analisi Matematica, Probabilità e Applicazioni).

Participant in the European Union projects "Evolution Equations" (HPRN-CT-2002-00281), "QP-Applications" (HPRN-CT-2002-00279) and Marie Curie Skłodowska ITN Grant "Controlled Systems" (GA 213841/2008).

Member of the Departmental Council ("Giunta di Dipartimento") of the Department of Mathematics at Politecnico di Milano in 1992-1993.

Coordinator of the students tutoring services at the Lecco branch of Politecnico di Milano in 1998-2000.

Deputy Head ("Vicedirettore") of the Department of Mathematics at Politecnico di Milano in 2002-2004.

Chairman of the Faculty of the PhD programme ("Coordinatore del Dottorato") in Mathematical Engineering at Politecnico di Milano in 2001-2006. Member of the PhD Faculty till 2016.

Deputy Head ("Vicepreside") of the School of Systems Engineering at Politecnico di Milano in 2011-2012.

Chairman of the Faculty of the Bachelor and Master programme ("Presidente del Consiglio di Corso di Studio") in Mathematical Engineering at Politecnico di Milano, January-July 2016.

Member of the Faculty of the PhD programme in Mathematical Sciences at Università di Milano since 2016.

Chairman of the Scientific Committee ("Presidente della Commissione Scientifica") at the Department of Mathematics, Università di Milano, 2017-2019.

Head of the Department of Mathematics ("Direttore del Dipartimento di Matematica"), Università di Milano, 2020-nowadays.

Organization of conferences

Summer school "Stochastic Control and Related Partial Differential Equations", in the framework of the Marie Curie Skłodowska ITN project "Deterministic and stochastic control systems". Università di Milano-Bicocca, June 27 - July 8, 2011.

Workshop "Topics in Stochastic Control", in the framework of the Marie Curie Skłodowska ITN project "Deterministic and stochastic control systems". Politecnico di Milano, July 11-13, 2011.

Workshop "Problemi differenziali di evoluzione: approcci deterministici e stocastici e loro interazioni". Politecnico di Milano, December 5-6, 2013.

6th RISM School on "Developments in Stochastic Partial Differential Equations" (lectures by Arnaud Debussche, Martin Hairer, Felix Otto). Varese, July 23-27, 2018.

"Random Transformations and Invariance in Stochastic Dynamics". Verona, March 25-29, 2019.

Evaluation and reviewing activity

Member of the editorial board of the journal *Applied Mathematics and Optimization* since 2017. Member of the editorial board of the journal *Stochastic Processes and their Applications* from 2019 to 2021.

I was a member of Committees for the selection of applicants to positions of Assistant Professor ("Ricercatore", in 2008, 2015 and 2018), Associate Professor (2014), Full Professor (2015). I also took part several times in the selection of applicants to PhD positions and to post-doc positions ("assegni di ricerca").

I was a member of the Jury ("opponent") in the PhD thesis defense of Salah Eddine Choutri, KTH Stockholm, February 1st, 2019.

I acted as a referee for the following journals: *Abstract and Applied Analysis*, *Annals of Probability*, *Applied Mathematics and Optimization*, *Automatica*, *Bulletin des Sciences Mathématiques*, *Discrete and Continuous Dynamical Systems A*, *Electronic Journal of Probability*, *Hiroshima Mathematical Journal*, *International Journal of Control*, *International Journal of Stochastic Analysis*, *Journal of Evolution Equations*, *Journal of Mathematical Analysis and Applications*, *Journal of Theoretical Probability*, *Mathematics of Control, Signals, and Systems*, *NoDEA - Nonlinear Differential Equations and Applications*, *Potential Analysis*, *Probability Theory and Related Fields*, *Semigroup Forum*, *SIAM Journal of Control and Optimization*, *SIAM Journal of Mathematical Analysis*, *Stochastic Partial Differential Equations: Analysis and Computations*, *Stochastic Processes and their Applications*, *Stochastics - An International Journal of Probability and Stochastic Processes*.

I was a referee of scientific proposals submitted for funding to: MIUR (PRIN 2009 projects), USA National Science Foundation (2005), European Research Council (2008), National Security Agency - American Mathematical Society (2015). I was a referee for the MIUR-VQR 2004-2010.

Direction of financed research projects

Director of a local unit of MIUR-PRIN 2015 project "Deterministic and stochastic evolution equations" (two-year project).

Principal investigator of the national MIUR-PRIN 2010-2011 project "Evolution differential problems: deterministic and stochastic approaches and their interactions" (a three-year research project of the Italian Ministry for University MIUR, involving five local units at the Universities of Lecce, Parma, Pisa, Trento and the Politecnico di Milano. Funding: 350 k€).

Director of a local unit of MIUR-PRIN 2008 project "Evolution equations" (two-year project).

Director of a local unit of MIUR-PRIN 2006 project "Kolmogorov's equations" (two-year project).

Principal investigator of the research project INDAM-GNAMPA "Backward stochastic differential equations and applications" in 2005 (one-year project).

Director of a local unit of MIUR-PRIN 2004 project "Kolmogorov's equations" (two-year project).

Director of a local unit of MIUR-PRIN 2002 project "Kolmogorov's equations" (two-year project).

Teaching and supervising activity In Italy I have taught several courses at Bachelor, Master and PhD level. I have been one of the main lecturers at the following courses at PhD level given at international schools:

Spring School “Stochastic Control in Finance” (Roscoff, France, March 7-18, 2010), in the framework of the Marie Curie Skłodowska ITN project “Deterministic and stochastic control systems”. Title of the course: “Hamilton-Jacobi-Bellman equations in infinite dimensions” (in collaboration with Fausto Gozzi - LUISS Rome).

Control of PDEs, interactions and application challenges (CIRM Marseille-Luminy, November 5-9, 2012). Title of the course: “Stochastic equations and control theory” (in collaboration with Anne de Bouard - CNRS et École Polytechnique).

9th Colloquium on BSDEs and Mean Field Systems (Annecy, France, June 27th-July 1st, 2022). Title of the course: “Control randomization method and BSDEs with constrained jumps”.

I have been the supervisor of several Bachelor students in Mathematical Engineering in the preparation of their final work (a thesis or an oral exposition).

I have been the Master thesis supervisor of several students in Mathematical Engineering and in Mathematics.

I have been the PhD thesis supervisor of the following students:

- Federica Masiero (Università di Milano, thesis defended in 2004, now Associate Professor at Università di Milano-Bicocca)
- Fulvia Confortola (Università di Milano, thesis defended in 2005, now Associate Professor at Politecnico di Milano)
- Anton Ibragimov (Marie Curie Skłodowska - ITN student, Università di Milano-Bicocca, thesis defended in 2010, recently at Barclays Bank - Kyiv)
- Andrea Cosso (Politecnico di Milano, thesis defended in 2014, now Full Professor at Università di Bologna)
- Carlo Orrieri (Università di Pavia, thesis defended in 2015, now Assistant Professor at Università di Pavia)
- Elena Bandini (Politecnico di Milano, thesis defended in 2016, now Assistant Professor at Università di Bologna).
- Alessandro Calvia (Università di Milano-Bicocca, thesis defended in 2018, now Assistant Professor at Università di Parma).
- Nahuel Foresta (Politecnico di Milano, thesis defended in 2018, recently in BNP-Paribas, London).
- Mattia Martini, Università di Milano, thesis defended in 2023, now post-doc at Université de Nice-Côte d’Azur.

I have been the scientific supervisor of the following post-doc students (in parentheses the approximate period):

- Giuseppina Guatteri (2002)
- Federica Masiero (2004)
- Fulvia Confortola (2005)
- Elisa Mastrogiacomo (2011)
- Petr Veverka (2015)

Talks at workshops and conferences (since 2006)

I have given the following talks in the framework of workshops or conferences (in quotation marks the title of the talk).

- Workshop on Stochastic Partial Differential Equations* (Pisa, April 3-7, 2006). "Some results on backward stochastic differential equations in infinite dimensions".
- Workshop on Kolmogorov Equations* (Parma, November 1-3, 2006). "Forward-backward systems of stochastic differential equations with random coefficients".
- Journées de Probabilités 2007* (La Londe les Maures, Toulon, September 10-14, 2007). "Optimal stochastic control and BSDEs in infinite dimensions".
- Stochastic partial differential equations and applications - VIII* (Levico Terme, Italy, January 6-12, 2008). "Some problems and results on functional stochastic differential equations".
- 5th Colloquium on Backward Stochastic Differential Equations, Finance and Applications* (Le Mans, June 18-20, 2008). "Some problems and results on functional stochastic differential equations".
- First CIRM-HCM Joint Meeting: Stochastic Analysis, SPDEs, Particle Systems, Optimal Transport* (Levico Terme, Italy, January 24-30, 2010). "Continuous-time Markov chains with noise-free observation: filtering and optimal stopping".
- The 6th International Symposium on Backward Stochastic Differential Equations and Applications* (Los Angeles, June 8-10, 2011). "Some results on the stochastic maximum principle in the optimal control of SPDEs".
- Control of PDEs, interactions and application challenges* (CIRM Marseille-Luminy, November 5-9, 2012). "Stochastic maximum principle in the optimal control of SPDEs".
- Evolution equations, deterministic and stochastic models and applications* (Trento, November 26-27, 2012). "Stochastic maximum principle in the optimal control of SPDEs".
- Backward stochastic differential equations* (Rennes, May 22-24, 2013). "BSDEs and point processes".
- Problemi differenziali di evoluzione: approcci deterministici e stocastici e loro interazioni* (Politecnico di Milano, December 5-6, 2013). "Optimal control and point processes".
- Stochastic partial differential equations and applications - IX* (Levico Terme, Italy, January 6-11, 2014). "Optimal control of point processes, backward stochastic differential equations and associated parabolic PDEs".
- Séminaire triangulaire de probabilités (Angers-Brest-Le Mans-Rennes)* (Rennes, November 10, 2014). "Optimal control of pure jump Markov processes and constrained backward stochastic differential equations".
- Stochastic partial differential equations and applications - X* (Levico Terme, Italy, May 30 - June 3, 2016). "Constrained backward stochastic differential equations and optimal control with partial observation".
- Stochastic analysis day* (Pisa, July 25, 2016). "Backward stochastic differential equations and optimal control with partial observation".
- Deterministic and stochastic evolution equations* (Parma, September 4-6, 2017). "The randomization method in stochastic optimal control and its applications".
- International Conference on Stochastic Analysis, Stochastic Control and Applications* (Hammamet, Tunisia, October 24-27, 2017). "Control randomization for infinite horizon optimal control problems".
- Opening Conference of the Thematic Semester on Stochastic Modelling* (Verona, December 18-21, 2017). "Partial observation optimal control and BSDEs".
- International Conference on Control, Games and Stochastic Analysis* (Hammamet, Tunisia, October 29 - November 1, 2018). "Optimal switching problems with an infinite set of modes: an approach by randomization and constrained BSDEs".
- Second Italian Meeting on Probability and Mathematical Statistics* (Vietri sul Mare (SA), Italy, June 17-20, 2019). "Optimal switching problems with an infinite set of modes: an approach by randomization and constrained backward SDEs".
- DEA - Dynamics, Equations and Applications* (Kraków, September 16-20, 2019). "Optimal control of stochastic evolution equations via randomization and backward SDEs".
- 9th Colloquium on BSDEs and Mean Field Systems* (Annecy, France, June 27th-July 1st, 2022). "Randomization method in optimal control and BSDEs with constrained jumps".

Seminars (since 2006)

Université de Rennes 1: "Forward-backward systems of stochastic differential equations with stochastic coefficients" (January 23, 2006).
Università di Pavia: "Equazioni differenziali stocastiche 'backward', equazioni a derivate parziali e problemi di controllo ottimo stocastico" (June 12, 2008).
Politecnico di Milano: "On a class of nonlinear PDEs on Hilbert spaces and applications" (June 11, 2009).
Université de Rennes 1: "Continuous-time Markov chains with noise-free observation: filtering and optimal stopping" (January 30, 2012).
Université Pierre et Marie Curie - Paris VI: "Backward stochastic differential equations and point processes" (February 21, 2013).
Université Paris Diderot "Optimal control of pure jump Markov processes and constrained backward stochastic differential equations" (May 7, 2105).
Université du Maine, Le Mans: "BSDEs for optimal control problems with partial observation" (October 15, 2015).
Università di Bologna: "Optimal switching problems: foundations and recent results" (April 1, 2019).
Mathematical Institute Oxford University: "Optimal control of stochastic evolution equations via randomisation and backward SDEs" (October 14, 2019).
UMI-PRISMA webinar: "A new tool in stochastic optimal control: the randomization method" (April 12, 2021).

Personal information

I authorize the handling of personal information in this curriculum, according to D.Lgs n. 196/03 and following modifications and Regulations EU 679/2016 (General Regulations concerning Data Protection or GRDP) and art. 7 of University Regulations concerning protection of personal information.

I authorize, according to D.lgs 14/03/2013 n. 33 concerning transparency, in case of conferment of the position and of the fellowship, the publication of this curriculum in the web site of Università degli Studi di Milano in the section "Amministrazione trasparente", "Consulenti e collaboratori".

Date and signature: