

# Filippo Santambrogio – CV

Born in Milan (Italy), on June 13th, 1980. Italian and French citizen, married, no children.

Full Professor in Applied Mathematics at Université Paris-Sud, Laboratoire de Mathématiques d'Orsay.

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## 1 Education, positions and awards

**2010-now** Professor at Université Paris-Sud, in the PDE and Numerical Analysis team. Promoted *1st class* professor in May 2014.

**2009** *Habilitation à diriger des recherches* (Habilitation thesis), defended at Paris-Dauphine (November 25th), presented by Ivar Ekeland. Title: *Problèmes classiques et moins classiques en transport optimal: régularité, approximation, EDP et applications*. Referees: J.-A. Carrillo, L. C. Evans, C. Villani.

**2007-2010** *Maître de Conférences* (permanent assistant professor position) at Université Paris-Dauphine in the “Mathematical Economics, Game Theory and Finance” team.

**2007** Post-doc at CMLA Cachan under the supervision of Jean-Michel Morel (January-August).

**2006** PhD in mathematics: Perfezionamento in Matematica at SNS. Thesis defended on December 12th, title *Variational problems in transport theory with mass concentration*, supervisor G. Buttazzo: 70/70 cum laude.

**2003-2006** PhD student in mathematics at SNS Pisa (first place in the national contest for the admission to the PhD program in Mathematics at SNS); supervisor: Giuseppe Buttazzo.

**2003** Laurea (Master Degree) in Mathematics at Università di Pisa: 110/110 cum laude; SNS Diploma: defense of the thesis *Optimal measures in an urban planning problem*, under the supervision of G. Buttazzo;

**1999-2003** Student at SNS Pisa and Università di Pisa (first place ex-aequo in the national examination for the admission to the Science Section of *Scuola Normale Superiore, Pisa*).

### Awards:

- Bronze medal at IMO, 1999, Bucharest;
- Premio B. Sciarra, given by SNS Pisa in 2003 (for master theses);
- Premio G. Iapichino, given by *Accademia dei Lincei* in 2007 (for young Italian researchers in mathematical analysis);
- Selected as junior member of IUF (Institut Universitaire de France), 2017.

## 2 Teaching, responsibilities, supervision

### 2.1 Teaching

Since 2007, I have been delivering courses on mathematical analysis (at a first and second year levels) and optimization (fourth and fifth year) on a regular basis in Paris-Dauphine, at Institut Tunis Dauphine, Polytech Paris-Sud, Paris-Sud, EN- SAE, ISSEA (Yaoundé, Cameroun), ENSAE Sénégal (Dakar), ENSAE (Malakoff). Moreover, I also gave more advanced courses, at a Master-PhD level, on Optimal Transport, Incompressible Euler Equations, Elliptic Equations and Calculus of Variations.

### 2.2 Main Pedagogical Responsibilities

- From 2011 to 2015, I have been director of the Master program *Équations aux Dérivées Partielles et Calcul Scientifique* (PDE and Scientific Computing) in Paris-Sud.
- Since September 2015, I am director of the Master program *Optimization*, created in 2015 in the framework of the Master “Mathématiques and Applications” of Paris-Saclay.
- From 2011 to 2015: member of the Doctoral Council of Paris-Sud.

## 2.3 Popular Science and activities with Schools

- Trainer for Mathematical Olympiads in Italy, between 2000 and 2005.
- Tutor for an academic orienteering workshop for high-school students, SNS Pisa, 2006.
- Supervisor of a one-week internship of a high-school student in a research lab, 2007.
- Pre-conferences to prepare high school classes to the public lecture given by C. Villani on J. Nash at BNF, 2010.
- Member of the editorial committee for the popular science brochure “L’explosion des mathématiques”, 2012.
- Lecture, interview and collaboration with a class of 10 yo students at Briis-sous-Forges, 2015.
- Seminar for freshmen students “Mathematik Park”, 2015.

## 2.4 Doctoral supervision

- Lorenzo Brasco, *cotutelle* Pisa-Dauphine, co-supervised (33%) with G. Buttazzo and G. Carlier. Thesis: “Geodesics and PDE methods in transport models”, defended in Oct. 2010. L. Brasco is now Associate Professor in Ferrara, Italy.
- Nicolas Bonnotte, *cotutelle* SNS Pisa - Orsay, co-supervised with L. Ambrosio (50%): “Unidimensional and evolution methods for optimal transport”. Defended in Dec. 2013. Nicolas is now working as a data scientist in the Saint-Gobain group.
- Jean Louet: “Problèmes de transport optimal avec pénalisation en gradient”. Defended in July 2014. Jean is now teacher at Classes Préparatoires in Versailles.
- Alpár Mészáros, “Mean Field Games with density constraints”. Defended in Sept. 2015. Alpár is now adjunct assistant professor at UCLA.
- Antonin Monteil, co-supervised (50%) with R. Ignat, “Semicontinuity and  $\Gamma$ -convergence under divergence constraints”. Defended in Dec. 2015. Antonin is now Chargé de Recherches FNRS in Louvain-La-Neuve, Belgium.
- Paul Pegon: “Fractal issues in branched transport”. The thesis has been submitted and the defense is scheduled in November 2017.
- Samer Dweik, 3rd year: “Estimates and regularity on transport densities”.
- Hugo Lavenant, 2nd year: “Optimization problems with several Wasserstein distances”.

I also supervised more than 10 master research internships at Orsay, Polytechnique, Paris 6, and Roma La Sapienza, 7 undergraduate projects, 5 research internships for the students of ENS Cachan and an ENSAE working group.

I also mentored two postdocs: Simone Di Marino (2014/2016) and Guilherme Mazanti (2016/ongoing).

## 2.5 Organization of scientific events

- Organization of the workshop “Optimal Transport and Applications to Economics”, Paris 2009 (Ecole des Mines), with G. Carlier and A. Galichon.
- Organization of the workshop “Optimal Transport (to) Orsay”, 2012, with F. Bolley, N. Bonnotte, G. Carlier, J. Louet.
- Co-organiser of the regular seminar on Calculus of Variations, in 2009/10 in Paris-Dauphine
- Since 2010: co-organiser of the Parisian Seminar on Optimization (SPO, held once per month at IHP).
- Organization of a working day on crowd motion for the ANR project ISOTACE, Orsay, 2013.
- Organization (with L. Moonens) of a working meeting of the ANR GEOMETRYA at Orsay, 2014.
- Organization (with L. Brasco, A. Briani, L. De Pascale, I. Fragalà and P. Trebeschi) of the international workshop “Calculus of Variations and Optimization (60th birthday of Giuseppe Buttazzo)”, 2014.
- Organization of a Winter School and an international workshop on “Optimal transport in the Applied Sciences”, in RICAM, Linz, 2014 (with G. Carlier and T. Champion). The total budget of the two events was 55k euros.
- Organization of a working day on Branched Transport, Orsay, 2016 (with A. Monteil and P. Pegon)
- Organization of a mini-symposium about “Calcul des Variations” in the PICOF 2016 conference, Autrans.
- Co-organization of a session on “Progress in Transport Phenomena” in the Barcelona Mathematical Days, April 2017.

## 2.6 Collaborative research projects

- Current member of two ANR projects for 2012/16: MAGA (Monge-Ampère and Géométrie Algorithmique, 2016/20, head: Q. Mérigot) and MFG (Mean Field Games, 2016/20, head: P. Cardaliaguet, Dauphine).
- Previously member of four ANR projects: OTARIE (2007/11, head: A. Sobolevskii, Moscow), EVAMEF (2009/12, head: A. Blanchet, Toulouse I), ISOTACE (head: J.-D. Benamou, INRIA), GEOMETRYA (head: H. Pajot, Grenoble)..
- 2013/16: head of a PGMO research project (11 members in 6 French universities, 25k euros budget).
- 2014/14: head of an iCODE project (9 members in 3 French universities, 11k euros budget).
- 2010: head of a French-Italian joint project (6 members in France, 6 in Italy, 6+6k euros).

## 2.7 Other responsibilities

### Scientific evaluation, scientific committees, hiring committees

- Referee for about 30 different journals in pure and applied mathematics.
- Reviewer for Mathscinet, till 2011.
- Reviewer of research projects for ERC and for national institutions in Belgium, Israel, Chile and Italy.
- Member of the scientific committee of PGMO (Programme Gaspard Monge pour l'optimization) since 2012.
- Member of the jury committee for the PhD award of PGMO, 2013, and president of the same committee, 2014.
- Member of the scientific committee of the MODE conference in Rennes, 2014, of the PGMO-COPI conference, Palaiseau, 2014, and of the French-German-Italian conference on Optimiation (Paderborn 2017).
- Member of the hiring committees of Université Pierre et Marie Curie (2009 and 2010), Université de Nice-Sophia Antipolis (2010), Université Paris-Dauphine (2010), Université Lyon 1 Claude Bernard (2011), Université Paris-Sud (2013, computer science, 2016, mathematics) and Université Toulouse III (2015).

### Editorial activity

- Associate Editor of ESAIM M2AN, Mathematical Modelling and Numerical Analysis, since 2017.
- Associate Editor of AMO, Applied Mathematics and Optimization, since 2017.
- Guest Editor for a special issue of Discrete and Continuous Dynamical Systems, Series A, on "*Optimal Transport and Applications*", co-edited with A. Figalli, published in 2014 (Vol. 34, no 4).
- Guest Editor for a special issue of ESAIM M2AN, on "*Optimal Transport in Applied Mathematics*" co-edited with B. Maury, published in 2015 (Vol. 49, No. 6).
- Co-Editor of a special volume on "New Trends in Calculus of Variations: Shape and topological optimization, Optimal Transport in the Applied Sciences", from the special semester at RICAM (published by De Gruyter in 2017).
- Guest Editor for a special issue of EJAM, European Journal of Applied Mathematics, on "*Applied Optimal Transport*" co-edited with M. Burger, G. Carlier, D. Matthes, in preparation.

### Various administratives responsibilities

- Since May 2015, elected member of the Department Council of my laboratory, LMO.
- Since 2015, member of the CCSU (Commission Consultative de Spécialistes de l'Université, in charge of the organization of the hiring procedures) in Mathematics and in Computer Sciences at Université Paris-Sud.

### 3 Talks, Invitations and Visits

#### 3.1 Selected Invited Talks in national and international conferences since 2012

- March 2012: *journées MODE* (Mathematics of Optimization and Decision, plenary speaker), Dijon;
- April 2012: international conference *PICOF* (plenary speaker), at Ecole Polytechnique;
- May 2012: “Geometry and Dynamics of Fluid”, *CRM, Montréal*;
- June 2012: “Monge-Kantorovich optimal transportation problem, transport metrics and their applications” dedicated to the centenary of L. V. Kantorovich, *Euler Institute, St Petersburg*;
- Nov 2012, *SNS Pisa*, Optimal Transportation and Applications;
- July 2013, New Developments in Stochastic Analysis, LIASFMA Summer School 2013, Beijing;
- July 2013, International workshop on stochastics in economics, finance and physics, Bielefeld;
- Aug 2013, *MSRI Berkeley*, Introductory Workshop on Optimal Transport: Geometry and Dynamics;
- Sept 2014, *Fields Institute, Toronto*, Optimization, Transport and Equilibrium in Economics;
- Oct 2014, *SNS Pisa*, Optimal Transportation and Applications;
- Feb 2015, *BIRS*, Canada, Advances in Numerical Optimal Transportation;
- Feb 2015, *HIM*, Bonn, New Trends in Optimal Transport;
- April 2015, *ICMS*, Edinburgh, Gradient Flows;
- June 2015, *IHP*, Paris, Mean field games and related topics;
- Sept 2015, *M3ST 2015* conference in Kalamata (Greece): plenary speaker;
- Oct 2015, *International Conference on Stochastic Analysis and Applications* in Hammamet, Tunisia;
- Nov 2015, *Imperial College*, London, Workshop on Mathematics and Social Sciences;
- Dec 2015, *IMS Workshop on Congestion Games*, Singapore;
- June 2016 *KIAS*, Seoul, Conference on Analysis, Geometry, and Optimal Transport;
- July 2016 *CRM* (Montréal), Computational Optimal Transportation;
- Nov 2016, *SNS Pisa*, Optimal Transportation and Applications;
- Mar 2017, *U. Münster*, Shape, Image and Optimization;
- April 2017, *U. Zürich*, Transport problems in Zurich;
- May 2017, *U. Warwick*, Non-local Equations and Fractional Diffusion;
- June 2017, *Colloque SMAI*, plenary speaker, Ronce-les-Bains;
- June 2017, *La Sapienza*, Rome, Mean field games and related topics;
- July 2017, *CMREF*, Manchester, Mathematical Economics and Finance;
- Aug 2017, *ICERM*, Brown University, Pedestrian Dynamics: Modeling, Validation and Calibration.;
- Sept 2017, *U. Padova*, Control of State-Constrained Dynamical Systems.

#### 3.2 Invited seminar talks

I've been invited to give talks in the seminars of several institutions in France (approx in 20 different universities), or abroad (Italy, Germany, UK, Ireland, Greece, Cyprus, Russia, China, Australia).

I also gave *Colloquium* type talks in Dijon, Limoges, Canberra and Münster and I have been invited to give one in Paris 5.

### 3.3 International Teaching Invitations

- Two short courses at the summer School of Institut Fourier in Grenoble in 2009, one on the general theory of optimal transport (3h), and one on transport models in economics (4h).
- A short lecture at a CIRM Summer School in Luminy in 2011 (6h), on branched transport.
- A course at Tsinghua University, Beijing, in the framework of the FMJH-Tsinghua Lectures, in April 2012. Course on Incompressible Euler Equations, shared with E. Miot (12h+12h).
- A course on optimal transport in the European Summer School on Math. Fin., E. Polytechnique (7.5h), 2012
- A mini-course (5h) on optimal transport at University of Athens, Greece, 2014, invited by N. Alikakos.
- A mini-course (5x45') on “Inside and around optimal transport” in Sant Feliu de Guíxols (Catalunya), in a workshop organized by the European network MANET, June 2015.
- Doctoral course “Optimal Transport and Applications” in Trento and Verona, 20h, March-April 2016.
- Short course (7h) during a thematic period in Lyon organized by the ANR GEOMETRYA, June 2016.
- Short course (3x1h15) during a Workshop/School on Stochastic PDEs, Mean Field Games and Biology at GSSI, L’Aquila, Sept 2017.
- Graduate course on Optimal transport, UCAD, Dakar, November 2017.

### 3.4 Longer international visits

- Bonn, 3 weeks in 2007, invited by F. Otto and Y. Brenier;
- UCLA, 1 month in 2008, in the special trimester on optimal transport;
- Fields Institute, Toronto, 1 month in 2014, in the special semester on variational problems;
- ANU, Canberra, 3 weeks in July 2015, invited by X.-J. Wang.
- Imperial College, London, UK: invited professor for 6 months, Jan-July 2017, with a joint CNRS-Imperial fellowship.