

Curriculum Vitae

Filippo Santambrogio

Maître de Conférences en Mathématiques Appliquées
Assistant Professor in Applied Mathematics

Born in Milan (Italy), June 13th, 1980,
Italian citizen, single

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Research interests :

Calculus of Variations, Optimal Transport, Shape Optimization,
PDEs, Geometric Measure Theory, Measure and BV spaces,
Equilibrium problems, Game Theory, economical applications

1 Studies, career and awards

1.1 Before PhD studies :

Bronze Medal in the 40th International Mathematical Olympiads, Bucharest, July 1999 ;

First place ex-aequo in the national examination for the admission to the Sciences Section of *Scuola Normale Superiore, Pisa (SNS)*, September 1999 ;

Laurea (Master Degree) in Mathematics at Università di Pisa, July 2003 : 110/110 cum laude ;

SNS Diploma : defense of the thesis *Optimal measures in an urban planning problem*, under the supervision of G. Buttazzo, December 2003 ;

PhD admission : first place in the contests for the admission to the PhD program in Mathematics both at SNS and Università di Pisa.

1.2 2004-2006 :

PhD student in mathematics at SNS Pisa since January 2004, supervisor : Giuseppe Buttazzo.

Research visit (January-April 2004) at Université Montesquieu-Bordeaux IV, financed by the European RTN Project “Homogeneization and Multiple Scale”, in order to work with Guillaume Carlier on urban planning models.

Studies Award for mathematics “Benedetto Sciarra”, awarded every two years by SNS (all students with a Master Degree in Mathematics, either Italian or foreign, are eligible), November 2004.

Research visit at ENS Cachan (January-June) : 6 months international grant by ENS Cachan to work at CMLA with Jean-Michel Morel on some branched transport themes and applications.

Teaching assistant at Università di Pisa, Mechanical Engineering (first-year calculus).

PhD in mathematics : Perfezionamento in Matematica à la Scuola Normale Superiore di Pisa. Thesis defended on December 12th, 2006, title *Variational problems in transport theory with mass concentration*, supervisor Giuseppe Buttazzo : 70/70 cum laude.

1.3 2007-2009 :

Jan 07- Aug 07 : *Post-doc* at CMLA Cachan (one year contract, financed by the French Ministry of Education and Research, I resigned after 8 months due to my hiring at Paris-Dauphine), to work under the supervision of Jean-Michel Morel.

Jan 07 - Jun 07 : Teaching assistant at Université Paris-Dauphine (linear algebra and differential calculus).

Hiring selection in France : *first place at Paris-Dauphine* (for a Maître de Conférences position on mathematical economics and related topics) *and Lyon 1* (MdC in EDP), ranked at ENS Lyon, Paris-Sud Orsay and at CNRS.

Award “Gioacchino Iapichino” by *Accademia dei Lincei*, the Italian Science Academy, (Italian mathematicians under 30, authors of a mathematical analysis paper or book, are eligible, organised every two years). I presented the paper “Optimal Channel Networks, Landscape Function and Branched Transport” as well as my scientific resume.

Hired as a Maître de Conférences at Université Paris-Dauphine, starting September 1st. Confirmed for a permanent position one year later.

PEDR (french salary bonus for research and theses direction), 2008-2012.

2 Talks and Invitations

2.1 Invited Talks

- November 2005, MSRI *Berkeley*, Optimal Mass Transport and its Applications ;
- October 2007, laboratoire Dieudonné, *Nice*, Micro-Workshop on optimal transportation ;
- April 2008, IPAM *UCLA*, Numerics and Dynamics for Optimal Transport ;
- July 2008, PIMS *UBC Vancouver*, Transport, optimization, equilibrium in economics ;
- November 2008, *SNS Pisa*, Optimal Transportation and Applications ;
- May 2009, *Conférence SMAI 09*, mini-symposium on Optimal Transport.
- due in October 2009, laboratoire Dieudonné, *Nice*, Mini-Workshop organized by the Nice-Pisa french-italian collaboration on optimal transport.

2.2 Contributed and seminal talks

During the years 2003-2008 I presented my works in several other workshops. I delivered a talk almost every year since 2004 at the Italian Calculus of Variations and Geometric Measure Theory yearly workshop in Levico Terme. I also gave talks in Chambéry (2003), Toulouse (2004), Florence and Pisa (2005), Metz (2006), at the CODE meeting in Paris (2007), in Haifa (2009).

I've been invited to give talks in the seminars of several universities in Italy, France, UK and Cameroon : in Pisa (both at the Maths, twice, and at the Mech. Eng. departments), Cachan, at the JLL laboratory in Paris 6, at Politecnico di Torino, at Ceremade in Paris-Dauphine (three times), at institut de Mathématiques de Bourgogne in Dijon, at Politecnico di Bari, at Dieudonné laboratory in Nice, at Maths Dept in Orsay (twice, in the Harmonic Analysis and in the PDEs groups), at UMPA in ENS Lyon, in Brest, in Pavia, in Oxford, at Ecole Polytechnique, in Chambéry and in Montpellier.

2.3 Short stays for collaborations or teaching

- June 2007, *Universität Bonn* : three weeks, invited by Y. Brenier and F. Otto for the Lipschitz Lectures (I worked with M. Bernot, A. Figalli and Y. Brenier) ;
- June 2007, *Wolfgang Pauli Institut, Wien* : mini-course on Branched Transport delivered together with J.-M. Morel ;
- December 2007, *Università di Pavia*, to work with A. Pratelli and G. Savaré ;
- March 2008 and April 2009, *ISSEA Yaoundé*, intensive course on Dynamical Optimization for Senior Students ;
- April 2008, IPAM *UCLA*, one month during the Optimal Transport Trimester ;
- due in June 2009, *IJF Grenoble*, three weeks for a summer school on optimal transport.

3 Scientific publications

Please look at the page cvgmt.sns.it/people/santambro to find all the files.

3.1 Articles published on peer reviewed international journals

- [1] G. Buttazzo and F. Santambrogio : “A Model for the Optimal Planning of an Urban Area”, *SIAM Journal on Mathematical Analysis*, Vol. 37, No.2, 2005, 514–530 ;
- [2] A. Brancolini, G. Buttazzo and F. Santambrogio : “Path Functionals over Wasserstein spaces”, *Journal of the European Mathematical Society*, vol. 8, No. 3, 2006, 415–434 ;
- [3] G. Carlier and F. Santambrogio : “A Variational Model for Urban Planning with Traffic Congestion”, *ESAIM Control Optimization and Calculus of Variations*, Vol. 11, No. 4, 2005, 595–613 ;

- [4] F. Santambrogio and P. Tilli : “Blow-up of Optimal Sets in the Irrigation Problem”, *The Journal of Geometric Analysis*, Vol. 15, No. 2, 2005, 343–362.
- [5] G. Buttazzo, F. Santambrogio and N. Varchon : “Asymptotics of an optimal compliance-location problem”, *ESAIM Control Optimization and Calculus of Variations*, Vol. 12, No. 4, 2006, 752–769 ;
- [6] F. Santambrogio “Transport and Concentration Problems with Interaction Effects”, *Journal of Global Optimization*, publié en ligne et prochainement imprimé, 2006 ;
- [7] J-M. Morel and F. Santambrogio, “Comparison of distances between measures”, *Applied Mathematics Letters*, vol. 20, No. 4, 2007, 427–432 ;
- [8] L. Ambrosio and F. Santambrogio, “Necessary optimality conditions for geodesics in weighted Wasserstein spaces”, *Rendiconti Lincei : Matematica e Applicazioni*, vol. 18, No. 1, 2007, 23–37 ;
- [9] F. Santambrogio “Optimal Channel Networks, Landscape Function and Branched Transport”, *Interfaces and Free Boundaries*, vol. 9, 2007, 149–169 ;
- [10] G. Buttazzo and F. Santambrogio, “Asymptotical compliance optimization for connected networks”, *Networks and Heterogeneous Media*, vol. 2, no. 4, 2007, 761–777.
- [11] G. Carlier, C. Jimenez and F. Santambrogio, Optimal transportation with traffic congestion and Wardrop equilibria, *SIAM Journal on Control and Opt.* **47** (3) : 1330–1350, 2008.
- [12] F. Santambrogio and F.-X. Vialard, “Extension to BV functions of the large deformation diffeomorphisms matching approach”, *C. R. Acad. Sci*, vol 347, no. 1-2, 2009, 27–32 ;
- [13] A. Brancolini, G. Buttazzo, F. Santambrogio and E. Stepanov, “Long-term planning versus short-term planning in the asymptotical location problem”, published online in *ESAIM Control Optimization and Calculus of Variations*, to appear in paper version ;
- [14] M. Bernot, A. Figalli and F. Santambrogio, “Generalized solutions for the Euler equations in one and two dimensions”, published online in *J. Math. Pures et Appl.*, to appear in paper version ;
- [15] F. Santambrogio, “Absolute continuity and summability of transport densities : simpler proofs and new estimates”, published on-line in *Calc. Var. Par. Diff. Eq.*, to appear in paper version.
- [16] J-M. Morel and F. Santambrogio, “The regularity of optimal irrigation patterns”, published online in *Archives for Rational Mechanics and Dynamics*, to appear in paper version ;

3.2 Accepted articles

- [17] F. Benmansour, G. Carlier, G. Peyré and F. Santambrogio, “Numerical Approximation of Continuous Traffic Congestion Equilibria”, accepted by *Net. Het. Media* ;
- [18] L. Brasco, G. Carlier, and F. Santambrogio, “Congested traffic dynamics, weak flows and very degenerate elliptic equations”, accepted by *J. Math. Pures et Appl.* ;
- [19] G. Buttazzo and F. Santambrogio, “A Transport Model for the Optimal Planning of an Urban Area”, to be published in *SIAM Review*, in the SIGEST part, Fall 2009.

3.3 Preprints and submitted papers

- [20] F. Santambrogio and F.-X. Vialard, “A semi derivation lemma on BV functions” ;
- [21] G. Carlier, A. Galichon and F. Santambrogio, “From Knothe’s transport to Brenier’s map and a continuation method for optimal transport” ;
- [22] F. Benmansour, G. Carlier, G. Peyré and F. Santambrogio, “Fast Marching Derivatives with Respect to Metrics and Applications” ;

- [24] F. Santambrogio, “A Modica-Mortola approximation for branched transport” ;
- [25] F. Balabdaoui, K. Rufibach and F. Santambrogio, “Least Squares estimation of two ordered monotone regression curves”.

3.4 Books

- [26] F. Santambrogio, “Variational problems in transport theory with mass concentration”, Edizioni della Normale, distributed by Birkhäuser, 2007. PhD thesis published by SNS after refereeing

4 Teaching, Students and Responsibilities

- Professor in charge of the 1st year course on Basic Calculus 2, 2007/08 and 2008/09.
- Member of the Jury committee for 1st year students at Paris-Dauphine, 2007/08 and of the admission committee for 2009/10.
- *Organisation of the workshop* Optimal Transport and Applications to Economics, Paris 2009 (Ecole des Mines), with G. Carlier and A. Galichon.
- Referee for *Arch. Ration. Mech. Anal.*, *J. Conv. Anal.*, *Int. Free Bound.*, *ESAIM COCV*, *Calc. Var. and Par. Diff. Eq.*, *J. Geom. Anal.*, *Comm. Math. Sci.* and *Fin. and Stoch.*
- Reviewer for *Mathscinet*.

PhD-level lectures

- Lectures on Optimal Transport and Application, IHP 2008 and Dauphine 2009, with F. Bolley and B. Nazaret ;
- Short course in Wien on Branched Transport, with J.-M. Morel,
- Two lectures in Grenoble at the IJF Summer School : introduction to optimal transport and Models and applications

Supervision activity

- Co-advisor with G. Carlier and G. Buttazzo of the thesis of Lorenzo Brasco (co-tutelle between Pisa and Dauphine), on transport problems, congestion and branching models, in connections with PDEs. The defense is supposedly due in Fall 2010.
- Stage advisor of L. Piozin, 3rd year student, on game theory issues in network problems.

Undergraduate Teaching

My current teaching duties include 192 of teaching per year (up to equivalence : a lecture counts more than a tutorial session).

- Lectures on Basic calculus, 1st year, Dauphine, 2008 and 2009.
- Lectures on Dynamical Optimization, 4th year, ISSEA Yaoundé, 2008 and 2009
- Tutorials of Linear Algebra, Basic Calculus, Advanced Calculus, Dynamical Programming, Functional Analysis, Dauphine and Pisa.
- Tutorials of Mathematics for Economists, École Polytechnique.
- Lecture notes on Basic Calculus 2 (Taylor Expansions, Riemann Integrals, solutions of ODEs), 70 pages.