

# Francesco Rossi

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## 1 Personal

Born on June 30th, 1983. Italian and French citizen.

## 2 Education

**B.Sc. in Mathematics:** from 10/2002 to 09/2004 (Milan, Italy)

**M.Sc. in Mathematics:** from 10/2004 to 07/2006 (SISSA and University, Trieste, Italy)

**Ph.D. in Applied Mathematics:** from 11/2006 to 26/10/2009

Title of the thesis:	Sub-Riemannian geometry and hypoelliptic heat equations on 3D Lie groups - with applications to image reconstruction
Supervisors:	BOSCAIN Ugo Vittorio, Research Director in CNRS France AGRACHEV Andrei, Professor at SISSA
Institution:	Université de Bourgogne - Dijon, France and SISSA - Trieste, Italy
Mark:	Très honorable (First class honours)
Awards:	French Ministry of Research Fellowship

**Habilitation à Diriger des Recherches :** Habilitation to supervise Ph.D. students.

Title of the thesis: Analyse des équations de transport avec vitesses non-locales et applications à la commande des foules

Date: June 9th, 2016.

Institution: Aix-Marseille Université, Marseille, France.

## 3 Employment

**Since September 2010:** Maître de Conférences

Institution:	Université Aix-Marseille, France
Teaching:	Polytech' Marseille - GII (Industrial and Computer Science Engineering)
Research:	LSIS - equipe ESCODI (Estimation, control and diagnosis)

**November 2009 - June 2010:** Postdoctoral fellow

Institution:	BCAM -Basque Center for Applied Mathematics, Bilbao, Spain
Supervisor:	E. Zuazua

## 4 Teaching activities

**2006-2009:** Exercise classes in Applied Mathematics, Dynamical Systems at ICTP Trieste, Burgundy University, Toulon University.

**Since 2010:** Assistant Professor at Polytech Marseille. Students 3rd-5th year in Industrial Engineering. Classes: Applied Mathematics (60h/year), Statistics (50h), Control Systems (50h), Regulation (30h).

Organization activities: Coordinator for International Students; Coordination of the Control Laboratory.

**2013-2014:** Master for Research Course "Control systems, Optimal Control, and path planning", 10h. Aix-Marseille Université.

**June 2015:** Ph.D. course "Control in finite and infinite dimension" 9h. Universities of Modena-Reggio Emilia-Ferrara-Parma.

## 5 Publications

### *Journal Articles*

- [1] U. BOSCAIN, F. ROSSI, *Invariant Carnot-Carathéodory metrics on  $S^3$ ,  $SO(3)$ ,  $SL(2)$  and Lens Spaces*, SIAM J. Contr. Optim., 47, no. 4, pp. 1851–1878, 2008.
- [2] A. AGRACHEV, U. BOSCAIN, J.-P. GAUTHIER, F. ROSSI, *The intrinsic hypoelliptic Laplacian and its heat kernel on unimodular Lie groups*, J. Funct. Analysis 256, pp. 2621–2655, 2009.
- [3] U. BOSCAIN, F. ROSSI, *Projective Reeds-Shepp car on  $S^2$  with quadratic cost*, ESAIM: Control, Optimisation and Calculus of Variations, 16, no. 2, pp. 275–297, 2010.
- [4] U. BOSCAIN, G. CHARLOT, F. ROSSI, *Existence of planar curves minimizing length and curvature*, Proceedings Steklov Institute of Mathematics, vol. 270, n. 1, pp. 43–56, 2010.
- [5] F. ROSSI, P. COLANERI, R. SHORTEN, *Padé discretization for systems with piecewise linear Lyapunov functions*, IEEE Transactions on Automatic Control, vol. 56, issue 11, pp. 2717–2722, 2011.
- [6] U. BOSCAIN, J.-P. GAUTHIER, F. ROSSI, *Hypoelliptic heat kernel on 3-step nilpotent Lie groups*, Contemporary Mathematics. Fundamental Directions, Vol. 42, pp. 48–61, 2011.
- [7] U. BOSCAIN, J. DUPLAIX, J.-P. GAUTHIER, F. ROSSI, *Anthropomorphic Image Reconstruction via Hypoelliptic Diffusion*, SIAM J. on Control and Optimization 50, pp. 1309–1336, 2012.
- [8] B. PICCOLI, F. ROSSI, *Transport equation with nonlocal velocity in Wasserstein spaces: convergence of numerical schemes*, Acta Applicanda Mathematicae 124, pp. 73–105, 2013.
- [9] F. ROSSI, *Large time behavior for the heat equation on Carnot groups*, Nonlinear Differential Equations and applications, Volume 20, Issue 3, pp. 1393–1407, 2013.
- [10] S. SAJJA, F. ROSSI, P. COLANERI, R. SHORTEN, *Extensions of “Padé Discretization for Linear Systems With Polyhedral Lyapunov Functions” for generalised Jordan structures*, IEEE Transactions on Automatic Control, Volume 58, Issue 8, pp. 2071–2076, 2013.
- [11] B. PICCOLI, F. ROSSI, *Generalized Wasserstein distance and its application to transport equations with source*, Archive for Rational Mechanics and Analysis, Volume 211, Issue 1, pp. 335–358, 2014.
- [12] R. DUIJS, U. BOSCAIN, F. ROSSI, Y. SACHKOV, *Association fields via cusplless sub-Riemannian geodesics in  $SE(2)$* , J. Mathematical Imaging and Vision, Volume 49, Issue 2, pp. 384–417, 2014.
- [13] U. BOSCAIN, R. DUIJS, F. ROSSI, Y. SACHKOV, *Curve cusplless reconstruction via sub-Riemannian geometry*, ESAIM:COCV, Volume 20, Issue 03, pp. 748–770, 2014.
- [14] M. FORNASIER, B. PICCOLI, F. ROSSI, *Mean-Field Sparse Optimal Control*, Phil. Trans. R. Soc. A, 372: 20130400, 2014.
- [15] U. BOSCAIN, J.-P. GAUTHIER, F. ROSSI, M. SIGALOTTI, *Approximate controllability, exact controllability, and conical eigenvalue intersections for quantum mechanical systems*, Communications in Mathematical Physics, Volume 333, Issue 3, pp. 1225–1239, 2015.
- [16] B. PICCOLI, F. ROSSI, E. TRÉLAT, *Control to flocking of the kinetic Cucker-Smale model*, SIAM J. Mathematical Analysis 47, no. 6, pp. 4685–4719, 2015.
- [17] B. PICCOLI, F. ROSSI, *On properties of the Generalized Wasserstein distance*, Archive for Rational Mechanics and Analysis, vol. 222, pp. 1339–1365, 2016.
- [18] P. GOATIN, F. ROSSI, *A traffic flow model with non-smooth metric interaction: well-posedness and micro-macro limit*, Comm. Math. Sciences, to appear.
- [19] J. MARINO, F. ROSSI, M. OULADSINE, J. PINATON, *An adaptive fault detection framework for semiconductor processes using Gaussian Time Error*, IEEE Trans. Ind. Elec., accepted.

*Preprints*

- [1] M. BONGINI, M. FORNASIER, F. ROSSI, F. SOLOMBRINO, *Mean-Field Pontryagin Maximum Principle*, submitted, arXiv:1504.02236.
- [2] M.L. DELLE MONACHE, B. PICCOLI, F. ROSSI, *Traffic regulation via controlled speed limit*, submitted, arXiv:1603.04785.
- [3] G. CIBELLI, S. POLIDORO, F. ROSSI, *Sharp Estimates for Geman-Yor Processes and applications to Arithmetic Average Asian options*, submitted, arXiv:1610.07838.
- [4] M. CAPONIGRO, B. PICCOLI, F. ROSSI, E. TRÉLAT, *Sparse Jurdjevic-Quinn stabilization of dissipative systems*, submitted, hal-01397843.
- [5] M. CAPONIGRO, B. PICCOLI, F. ROSSI, E. TRÉLAT, *Mean-Field Sparse Jurdjevic-Quinn control*, submitted, hal-01426410.

*Chapters in books*

- [B1] A. AYDOGDU, M. CAPONIGRO, S. MCQUADE, B. PICCOLI, N. POURADIER DUTEIL, F. ROSSI, E. TRÉLAT, *Interaction Network, State Space and Control in Social Dynamics*, submitted.

*Proceedings*

- [P1] U. BOSCAIN, J. DUPLAIX, J.-P. GAUTHIER, F. ROSSI, *Image Reconstruction via Hypoelliptic Diffusion on the Bundle of Directions of the Plane*, in *Mathematical Image Processing, Springer Proceedings in Mathematics*, Vol. 5, Ed. M. Bergounioux, 2011.

*Thesis*

- [T1] F. ROSSI, *Problemi di geometria sub-Riemanniana su gruppi di Lie compatti*, tesi di laurea magistrale, SISSA and Università di Trieste, Italy, 115 pages, 2006.
- [T2] F. ROSSI, *Sub-Riemannian geometry and hypoelliptic heat equations on 3D Lie groups - with applications to image reconstruction*, Thèse de doctorat, U. Bourgogne, Dijon, France, 2009.
- [T3] F. ROSSI, *Analyse des équations de transport avec vitesses non-locales et applications à la commande des foules*, document for Habilitation for supervising Ph.D. students (HDR), 95 pages, 2015.

## 6 Conferences and seminars

*Presentations in international conferences*

- [C1] F. ROSSI, *Sub-Riemannian geometry on 3-D simple Lie groups and lens spaces*, L. S. Pontryagin Centennial Anniversary Conference, Moscow, Russia, 19/06/2008.
- [C2] F. ROSSI, *Projective Reeds-Shepp car on  $S^2$* , International conference on Differential Equations and Dynamical Systems, Suzdal, Russia, 01/07/2008.
- [C3] U. BOSCAIN, F. ROSSI, *Sub-Riemannian geometry on 3-D simple Lie groups*, Mathematical Theory of Network and Systems 2008 - Virginia Tech, Blacksburg, VA, U.S.A., 29/07/2008.
- [C4] U. BOSCAIN, F. ROSSI, *Minimization of length and curvature on the 2-sphere*, Mathematical Theory of Network and Systems 2008 - Virginia Tech, Blacksburg, VA, U.S.A., 29/07/2008.
- [C5] U. BOSCAIN, F. ROSSI, *Shortest paths on 3-D simple Lie groups with nonholonomic constraint*, 47th IEEE Conference on Decision and Control - Cancun, Mexico, 9-11/12/2008.
- [C6] U. BOSCAIN, G. CHARLOT, F. ROSSI, *Minimization of length and curvature on planar curves*, 48th IEEE Conference on Decision and Control - Shanghai, China, 16-18/12/2009.
- [C7] U. BOSCAIN, J. DUPLAIX, J.-P. GAUTHIER, F. ROSSI, *Image reconstruction via hypoelliptic diffusion on the bundle of directions of the plane*, Math. Image processing - Orléans, France, 30/03/2010.

- [C8] U. BOSCAIN, J. DUPLAIX, J.-P. GAUTHIER, F. ROSSI, *Image reconstruction via optimal control on the bundle of directions of the plane*, 49th IEEE Conf. Decision and Control - Atlanta, GA, U.S.A., 15-17/12/2010.
- [C9] F. ROSSI, P. COLANERI, R. SHORTEN, *Preservation of piecewise-linear Lyapunov function under Padé discretization*, 50th IEEE Conf. on Decision and Control - Orlando, FL, U.S.A., 12-15/12/2011.
- [C10] U. BOSCAIN, R. DUITTS, F. ROSSI, Y. SACHKOV, *Optimal control for reconstruction of curves without cusps*, 51th IEEE Conf. on Decision and Control - Maui, Hawaii, U.S.A., 10-13/12/2012.
- [C11] B. PICCOLI, F. ROSSI, *Control of multiscale model for social dynamics*, American Control Conference - Portland, Oregon, U.S.A., 4-6/6/2014.
- [C12] U. BOSCAIN, J.-P. GAUTHIER, F. ROSSI, M. SIGALOTTI, *Controllability of quantum mechanical systems: from conical eigenvalue intersections to Lie bracket conditions*, 21st Mathematical Theory of Networks and Systems, Groningen, The Netherlands, July 7-11, 2014.
- [C13] M. FORNASIER, B. PICCOLI, N. POURADIER DUTEIL, F. ROSSI, *Mean-field Optimal Control by Leaders*, 53rd IEEE Conf. on Decision and Control - Los Angeles, CA, U.S.A., 15-17/12/2014.
- [C14] M.L. DELLE MONACHE, B. PICCOLI, F. ROSSI, *Traffic flow control: avoiding shocks via variable speed limit*, 86th Annual Meeting of the International Association of Applied Mathematics and Mechanics - Lecce, Italy, March 23-27, 2015.
- [C15] M. BONGINI, M. FORNASIER, F. ROSSI, F. SOLOMBRINO, *Mean-field Optimal Control by Leaders*, 13th Viennese Workshop Optimal Control and Dynamic Games, Vienna, Austria, May 13-16, 2015.
- [C16] B. PICCOLI, F. ROSSI, E. TRÉLAT, *Control of the 1D continuous version of the Cucker-Smale model*, 2015 American Control Conference, Chicago, IL, USA, July 1-3, 2015.
- [C17] N. POURADIER DUTEIL, F. ROSSI, U. BOSCAIN, B. PICCOLI, *Developmental Partial Differential Equations*, 54th IEEE Conference on Decision and Control, Osaka, Japan, December 15-18, 2015.
- [C18] U. BOSCAIN, J.-P. GAUTHIER, F. ROSSI, M. SIGALOTTI, *Equivalence between exact and approximate controllability for finite-dimensional quantum systems*, 54th IEEE Conference on Decision and Control, Osaka, Japan, December 15-18, 2015.
- [C19] J. MARINO, F. ROSSI, M. OULADSINE, J. PINATON, *Gaussian Time Error: a fault detection index for semiconductor processes*, 2016 European Control Conf., Aalborg, Denmark, 2016.
- [C20] M.L. DELLE MONACHE, B. PICCOLI, F. ROSSI, *Outflow tracking with variable speed limit*, 2016 American Control Conference, Boston, MA, USA, July 6-8, 2016.
- [C21] J. MARINO, F. ROSSI, M. OULADSINE, J. PINATON, *Gaussian Time Error: a new index for fault detection in semiconductor processes*, 2016 Amer. Control Conf., Boston, MA, USA, July 6-8, 2016.
- [C22] B. PICCOLI, F. ROSSI, E. TRÉLAT, *Sparse kinetic Jurdjevic-Quinn control for mean-field equations*, 55th IEEE Conference on Decision and Control, Las Vegas, NV, December 12-14, 2016.
- [C23] F. ROSSI, N. POURADIER DUTEIL, N. YACOBY, B. PICCOLI, *Control of reaction-diffusion equations on time-evolving manifolds*, 55th IEEE CDC, Las Vegas, NV, December 12-14, 2016.
- [C24] M. CAPONIGRO, B. PICCOLI, F. ROSSI, E. TRÉLAT, *Sparse Feedback Stabilization of Multi-Agent Dynamics*, 55th IEEE Conference on Decision and Control, Las Vegas, NV, December 12-14, 2016.

**Seminars:** besides the conferences stated above, I gave 25 talks in Italy, France, Germany.

## 7 Grants

**ANR JCJC 2016-2019:** P.I. of the French Grant for Young Researchers.

Topic: “Control of Crowds: from control theory to applications to road traffic”.

Grant: 208.000 €. Collaborators: A. Giua and M. Morancey.

**PICS CNRS 2016-2019:** Grant for French-American collaboration, with B. Piccoli (Rutgers, NJ).

**PHC PROCOPE 2014-15:** Grant for French-German collaboration, with M. Fornasier (TU-Munich).  
Topic: “Sparse Control of Multiscale Models of Collective Motion”.

**Institut Carnot STAR 2013:** Grant for collaboration with R. Colombo (U. Brescia, Italy).

## 8 Conference organization

**2–6/12/2013: MCT: Mathematical Control in Trieste** SISSA, Trieste, Italie.

Co-organized with A. Agrachev, J.-M. Coron, J.-P. Gauthier, E. Trélat, E. Zuazua;  
C. Altafini, U. Boscain, R. Ghezzi.

Supported by IFAC, ERC, European Science Foundation, GNAMPA-Indam, GDR CON-EDP.

**12–14/12/2016: 55th IEEE Conference on Decision and Control** Las Vegas, Nevada, USA.

CDC is recognized as the premier scientific and engineering conference dedicated to the advancement of the theory and practice of systems and control.

**I am the Publicity Chair.** Gen. Chair: A. Giua (Univ. Cagliari, Italy and Aix-Marseille Univ).

**I also organized 3 other smaller conferences in France and U.S.A.**

## 9 Habilitations

**Italy:** ASN Seconda Fascia: 01/A3 Analisi Matematica, Probabilità e Statistica Matematica.

Habilitation for applying to Associate Professor positions in Mathematical Analysis.

**France:** Habilitation à Diriger des Recherches, June 9th 2016.

Habilitation for supervising Ph.D. students. Necessary to apply for Professor position.

## 10 Students supervision

**Since October 2016:** B. Bonnet, Ph.D. student, funded by Labex Archimède (French Excellence grant).  
Topic: Control of Crowds.

**Since October 2014:** J. Marino, Ph.D. student at ST Microelectronics- LSIS.

Topic: Diagnostic of production equipments with Principal Component Analysis.

**Other students:** I supervised 7 Engineering students during their internships, both at Aix-Marseille Univ. and Rutgers Camden, USA.

## 11 Editorial activity and reviews

**Associate editor for IEEE CSS Conference Editorial Board.**

**Academic:** reviewer for AMS Reviews (MathSciNet), IEEE TAC, SIAM J. Math. Analysis, SIAM J. Cont. Opt., ESAIM : COCV, J. Differential Equations, Systems & Control letters, and other 5 journals.

**Industrial:** reviewer for the French Ministry of University and Research in projects related to Tax Credit for Research (Crédit d’Impôt Recherche).

## 12 Other skills

Language skills: Italian (native), English (fluent), French (fluent), Spanish (basic).

Computer programming skills: C, C++, databases (SQL), mathematical software (MATLAB, Mathcad, Mathematica, LATEX), webpages (HTML, PHP).

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