

# Francesco Rossi

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## 1 Personal

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

## 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: 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

**Habilitation à Diriger des Recherches :** 09/06/2016. French habil. to supervise Ph.D. students.

Title: Analyse des éq. de transport avec vitesses non-locales et applications à la commande des foules.

Institution: Aix-Marseille Université, Marseille, France.

## 3 Employment

**Since September 2017:** Professore associato in Mathematical Analysis (MAT/05)

Università di Padova, Italy, Dipartimento di Matematica "Tullio Levi-Civita"

**September 2010-September 2017:** 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

**2010-2017:** 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.

**June 2015:** Ph.D. course "Control in finite and infinite dimension" 9h. University of Modena.

**Since 2017:** Associate Professor at Università di Padova.

Course "Analysis 1": 96h for students 1st year in Mechanical Eng. (2017), in Mechatronics Eng. (2018-).

Course "Introduction to Partial Differential Equations": 48h for students 4th-5th year in Mathematics.

Founder of the **MAPPA double-degree program** with PSL-Paris Dauphine [mappa.math.unipd.it](http://mappa.math.unipd.it)

## 5 Publications

- [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 Trans. 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. DUITS, 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. DUITS, 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, Vol. 15 (1), pp. 261–287, 2017.
- [19] M.L. DELLE MONACHE, B. PICCOLI, F. ROSSI, *Traffic regulation via controlled speed limit*, SIAM J Control Optimization, 55(5), pp. 2936–2958, 2017.
- [20] M. CAPONIGRO, B. PICCOLI, F. ROSSI, E. TRÉLAT, *Sparse Jurdjevic-Quinn stabilization of dissipative systems*, Automatica, 86, pp. 110–120, 2017.
- [21] M. CAPONIGRO, B. PICCOLI, F. ROSSI, E. TRÉLAT, *Mean-Field Sparse Jurdjevic-Quinn control*, Mathematical Models and Methods in Applied Sciences, Vol. 27, No. 7, pp. 1223–1253, 2017.

- [22] M. BONGINI, M. FORNASIER, F. ROSSI, F. SOLOMBRINO, *Mean-Field Pontryagin Maximum Principle*, Journal of Optimization Theory and Applications, Vol. 175, pp. 1–38, 2017.
- [23] B. BONNET, F. ROSSI, *The Pontryagin Maximum Principle in the Wasserstein Space*, Calc. Var. PDE, 58:11, 2019.
- [24] M. DUPREZ, M. MORANCEY, F. ROSSI, *Approximate and exact controllability of the continuity equation with a localized vector field*, SIAM J. Control Optim, 57-2, pp. 1284-1311, 2019.
- [25] G. ALBI, M. BONGINI, F. ROSSI, F. SOLOMBRINO, *Leader formation with mean-field birth and death models*, Math. Mod. Meth. Applied Sciences, Vol. 29, No. 04, pp. 633-679, 2019.
- [26] B. PICCOLI, F. ROSSI, *Measure dynamics with Probability Vector Fields and sources*, Discrete & Continuous Dynamical Systems - A, Vol. 39(11), pp. 6207–6230, 2019.
- [27] B. BONNET, J.-P. GAUTHIER, F. ROSSI, *Generic Singularities of the 3D-Contact sub-Riemannian Conjugate Locus*, Comptes Rendus Acad. Sciences - Math, Vol. 357 (6), pp. 520–527, 2019.
- [28] G. CIBELLI, S. POLIDORO, F. ROSSI, *Sharp Estimates for Geman-Yor Processes and applications to Arithmetic Average Asian options*, J. Math. Pures Appl., Vol. 129, pp. 87–130, 2019.
- [29] M. DUPREZ, M. MORANCEY, F. ROSSI, *Minimal time for the continuity equation controlled by a localized perturbation of the velocity vector field*, J. Diff. Eq., Volume 269 (1), pp. 82–124, 2020.
- [30] J.-P. GAUTHIER, F. ROSSI, *A universal gap for non-spin quantum systems*, Proc. AMS 149 (3), pp. 1203–1214, 2021.
- [31] B. BONNET, F. ROSSI, *Intrinsic Lipschitz Regularity of Mean-Field Optimal Controls*, SIAM J Control, 59-3, pp. 2011–2046, 2021.
- [32] B. PICCOLI, F. ROSSI, *Generalized solutions to bounded-confidence models*, Math. Mod. Meth. Applied Sciences 31 (6), pp. 1237–1276, 2021.
- [33] F. BOAROTTO, L. CARAVENNA, F. ROSSI, D. VITTONI, *On the Lebesgue measure of the boundary of the evolved set*, Systems & Control Letters 158-105078, 2021.
- [34] J. A. CARRILLO, D. KALISE, F. ROSSI, E. TRÉLAT, *Controlling swarms towards flocks and mills*, SIAM J Control, accepted, arXiv:2103.07304.

### Preprints

- [Pr1] B. PICCOLI, F. ROSSI, M. TOURNUS, *A norm for signed measures, with application to non local transport equation with source term*, submitted, hal-01665244v2.
- [Pr2] G. CIAMPA, F. ROSSI, *Vanishing viscosity for mean-field optimal control of continuity equations*, submitted, arXiv:2111.13015.
- [Pr3] L. LOMBARDINI, F. ROSSI, *Obstructions to extension of Wasserstein distances for variable masses*, submitted, arXiv:2112.04763.
- [Pr4] M. BERTIN, J. GALLI, F. ROSSI, *Retracing Reconstruction. Establishing an analytical method for the comprehension and systematisation of urban metamorphosis following extreme events*, submitted.

### 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*, in Active Particles, Volume 1, pp. 99–140, Mod. Simul. Science, Eng. Technology, Birkhäuser Math., 2017.
- [B2] B. PICCOLI, F. ROSSI, *Measure-theoretic models for crowd dynamics*, in Crowd Dynamics Vol. 1, N. Bellomo and L. Gibelli Eds, Birkhauser, 2018.
- [B3] F. CERAGIOLI, P. FRASCA, B. PICCOLI, F. ROSSI, *Generalized solutions to opinion dynamics models with discontinuities*, in Crowd Dynamics Vol. 3, N. Bellomo and L. Gibelli Eds, Birkhauser, to appear.

## 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.

## 6 Conferences and seminars

### 6.1 Invited presentations

- [Inv1] F. ROSSI, *Image reconstruction via hypoelliptic diffusion on the bundle of directions of the plane*, Math. Image proc. - Orléans, France, 30/03/2010.
- [Inv2] F. ROSSI, *Controllability and optimal control of the transport equation with localized vector fields*, Optimal Control and Mean Field Games, 19-21 September 2018, Pavia, Italy.
- [Inv3] F. ROSSI, *Controllability and minimal time for control of the transport equation*, Analysis, Control and Inverse Problems for PDEs, LIA COPDESC, 26-30/11/2018, Napoli, Italy.

### 6.2 Presentations in international conferences

#### 25 conference presentations in 2008-2016

- [C26] M. DUPREZ, F. ROSSI, M. MORANCEY, *Controllability and Optimal Control of the Transport Equation with a Localized Vector Field*, 25th Med. Conf. Control Autom., Malta, July 3-6, 2017.
- [C27] J. MARINO, F. ROSSI, M. OULADSINE, J. PINATON, *Unsupervised Semiconductor Chamber Matching Based on Shape Comparison*, IFAC World 2017, Toulouse, France, July 9-14, 2017.
- [C28] B. BONNET, F. ROSSI, *Sparse Control of Kinetic Cooperative Systems to Approximate Alignment*, IFAC 2017 World Congress, Toulouse, France, July 9-14, 2017.
- [C29] M. DUPREZ, F. ROSSI, M. MORANCEY, *Controllability and minimal time for control of the transport equation*, 57th IEEE Conf. Dec. Control, Miami Beach, FL, December 17-19, 2018.
- [C30] F. ROSSI, *A Pontryagin Maximum Principle for Constrained Multi-Agent Optimal Control Problems*, XXI UMI Congress, Pavia, Italy, 2-7/9/2019.
- [C31] L. LOMBARDINI, F. ROSSI, *Obstruction to extension of Wasserstein distances for variable masses*, SIMAI 2020+2021, Parma, 2021.
- [C32] F. BOAROTTO, F. ROSSI, *When does the evolved set have negligible boundary?*, 60th IEEE Conf. Dec. Control, Austin TX, USA, 2021.
- [C33] G. CIAMPA, F. ROSSI, *Vanishing viscosity for linear-quadratic mean-field control problems*, 60th IEEE Conf. Dec. Control, Austin TX, USA, 2021.
- [C34] B. BONNET, F. ROSSI, *Variance Optimization and Control Regularity for Mean-Field Dynamics*, LHMNC 2021, Berlin, 2021.

**Online seminar:** Control and regularity for non-local transport equations, Seminar at Univ. Erlangen Chair in Applied Analysis, <https://www.video.uni-erlangen.de/clip/id/24910>

## 7 Grants

**STARS@UNIPD 2019-2021:** P.I. of a local grant to support applications to Consolidator ERC.

Topic: “Control of Nonlocal Equations for Crowds and Traffic models”. Grant: 140.000 €.

**ANR JCJC 2016-2019:** P.I. of the French Grant for Young Researchers. Grant: 208.000 €.

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

Stopped in 2017 for moving to University of Padova, Italy.

**Grants for international cooperation** from Fondazione Cariparo (Italy-France), CNRS (France-USA), French PHC (France-Germany), French Carnot Institute (France-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,...

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.

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

**3–7/06/2019: Crowds: models and control** CIRM Marseille, France.

Co-organized with P. Caines, P. Goatin, S. Hoogendoorn, N. Leonard, E. Trélat, A. Giua,...

Presentations of 23 senior and 10 junior speakers.

**11–13/12/2019: 58th IEEE Conference on Decision and Control** Nice, France.

I am the Publicity Chair. General Chair: C. Canudas-de-Wit (CNRS GIPSA-Lab, France).

**I also organized 5 other smaller conferences in France, Italy, U.S.A.**

## 9 Habilitations

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

ASN Seconda Fascia: 09/G1 Automatica.

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

Qualification Professeur: Section 26 Mathématiques appliquées et Section 61 Automatique

## 10 Students supervision

- 2021 – L. Lombardini, Post-Doc, funded by STARS@UNIPD.
- 2020 – 2021 G. Ciampa, Post-Doc, funded by STARS@UNIPD.
- 2020 – A. Delyon, Post-Doc, funded by STARS@UNIPD.
- 2020 – M. Bentaibi, Ph.D. student, funded by Department of Mathematics Excellence grant.
- 2016 – 2018 M. Duprez (now CR INRIA, Strasbourg, FR), Post-Doc, funded by Archimède.
- 2016 – 2019 B. Bonnet, Ph.D. student, funded by Archimède - French Excellence grant.
- 2014 – 2017 J. Marino, Industrial Ph.D. student, in collaboration with ST Microelectronics.

## 11 University Third Mission: school, society, dissemination

**2017-:** Activities with “Math.en.Jeans” (high school) and KidsUniversity (junior high school)

**2018-:** member of the “Third mission and formation of teachers” Commission of Math. Dept.

## 12 Editorial activity and reviews

**Associate editor for IEEE CSS Conference Editorial Board and EUCA CEB.**

Reviewer for AMS Reviews (MathSciNet), SIAM J. Math. Analysis, SIAM J. Cont. Opt., Automatica, IEEE TAC, IEEE TCNS, ESAIM : COCV, J. Differential Equations, and other 6 journals.

## 13 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).