Francesco Rossi

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1 Personal

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

2 Education

B.Sc. in Mathematics: 09/2004 (Univ. Milan, Italy)

M.Sc. in Mathematics: 07/2006 (SISSA and Univ. Trieste, Italy)

Ph.D. in Applied Mathematics: 10/2009 (Univ. Bourgogne - Dijon, France and SISSA - Trieste, Italy)

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

Habilitation à Diriger des Recherches : 09/06/2016 (Aix-Marseille Université, Marseille, France)

3 Employment

Since September 2023: Professore ordinario in Mathematical Analysis (MAT/05)
Università Iuav di Venezia, Italy, Dipartimento di Culture del Progetto

September 2017-August 2023: Professore associato in Mathematical Analysis (MAT/05)
Università di Padova, Italy, Dipartimento di Matematica "Tullio Levi-Civita"

September 2010-September 2017: Maître de Conférences - Université Aix-Marseille, France

November 2009-June 2010: Postdoctoral fellow - BCAM Bilbao, Spain

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).
2017-2023: Associate Professor at Università di Padova.
Founder of the **MAPPA double-degree program** with PSL-Paris Dauphine `mappa.math.unipd.it`
Course "Analysis 1": 96h for students 1st year in Mechanical Eng. (2017), in Mechatronics Eng. (2018-).
Course "Mathematical Methods": 48h for students 3th year in Mathematics (2021-23).

5 Publications

[1] U. Boscain, F. Rossi, *Invariant Carnot-Caratheodory 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 cuspless 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 cuspless 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. Vittone, *On the Lebesgue measure of the boundary of the evoluted 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, 60-3, pp. 1863–1891, 2022.

[35] L. Lombardini, F. Rossi, *Obstructions to extension of Wasserstein distances for variable masses*, Proc. AMS, Vol. 150 (11), pp. 4879–4890, 2022.

[36] G. Ciampa, F. Rossi, *Vanishing viscosity for mean-field optimal control of continuity equations*, ESAIM COCV, Vol. 29, article 29, 2023.

[37] B. Piccoli, F. Rossi, M. Tournus, *A norm for signed measures, with application to non local transport equation with source term*, Comm. Math. Sciences, Vol. 21 (5), pp. 1279–1301, 2023.

[38] M. Bertin, J. Galli, F. Rossi, *Retracing reconstruction. An assessment method for urban metamorphoses following extreme events*, Journal of Urban Design, accepted, arXiv:2201.04067.

Preprints

[Pr1] A. Ajami, J.-P. Gauthier, F. Rossi, Jointly Equivariant Dynamics for Interacting Particles, submitted, arXiv:2307.13087.

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, pp. 11–47, 2021.

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.

[Inv4] F. Rossi, *The role of generalized solutions in opinion formation*, Two-day workshop on deterministic and stochastic control, 6-7/9/2022, Milano, 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 evoluted 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, Germany, 2021.

[C35] P. Frasca, F. Rossi, *Caratheodory Solutions to Opinion Dynamics with Topological Interactions and their Associated Graphs*, MTNS 2022, Bayreuth, Germany, 2022.

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

PRIN 2022 PNRR: P.I. of an Italian grant (3 units - 9 researchers).

Topic: "HeRo-MAC - Heterogeneity on the Road - Modeling, Analysis, Control". Grant: 299.921 €.

I quit the project after moving to Iuav Venezia, Italy.

STARS@UNIPD 2019-2023: 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.

12–14/12/2016: 55th IEEE Conference on Decision and Control Las Vegas, Nevada, USA.
I was 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 was the Publicity Chair. General Chair: C. Canudas-de-Wit (CNRS GIPSA-Lab, France).

23–27/5/2022: 100 anni UMI-800 anni UniPD Padova, Italy.
I was part of the Organizing committee with F. Ancona, M. Ferrante, A. Bianchi...

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

2022 –	N. Pogodaev, Post-Doc, funded by STARS@UNIPD
2021 – 2022	L. Lombardini, Post-Doc, funded by STARS@UNIPD
2020 – 2021	G. Ciampa, Post-Doc, funded by STARS@UNIPD
2020 – 2022	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 French Excellence grant
2016 – 2019	B. Bonnet (now CR CNRS, Toulouse, FR), Ph.D. student, funded by French Exc. grant
2014 – 2017	J. Marino, Industrial Ph.D. student, in collaboration with ST Microelectronics

11 University Third Mission: school, society, dissemination

2017-23: Activities with "Math.en.Jeans" (high school) and KidsUniversity (junior high school)
2018-23: 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).