

# Andrei A. Agrachev

## Curriculum Vitae

### Mailing Address

International School for Advanced Studies  
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### Born

March 29, 1952. Moscow, USSR

### Education

Moscow State University, 1969 – 1977 (undergraduate, graduate, and post-graduate studies)

### Degrees and Honors

- Ph.D., Moscow State University 1977. Title of Ph.D. Thesis: “Second Order Necessary Optimality Conditions.”
- Doctor of Sciences, Steklov Mathematical Institute 1989. Title of Doctoral Dissertation: “Topology of Quadratic Mappings and Optimal Control Theory.”
- Soviet Academy of Sciences Award in Mathematics, 1989.
- Invited Speaker at the International Congress of Mathematicians ICM-94 in Zürich, Switzerland.
- Member of the Nevanlinna Prize Committee of the International Mathematical Union for ICM-2002 in Beijing, China.
- American Mathematical Society featured review, 2002.
- Panel core member of the International Mathematical Union for ICM-2010 in Hyderabad, India.

- Chair Jean D’Alambert, 2016.
- Inria International Chair, 2020–2024.

## Professional Activity

- All-Union Institute for Scientific Information (VINITI), Moscow, Russia, 1977 – 92. Positions: researcher, senior researcher, leading researcher.
- Steklov Mathematical Institute, Moscow, Russia, 1992 – present. Positions: leading researcher, external collaborator.
- Moscow State University, Department of Mechanics and Mathematics, 1989 – 1997. Positions: associate professor, full professor.
- International School for Advanced Studies (SISSA), Trieste, Italy, 2000 – present. Position: full professor.
- Member of scientific committees of the international conferences: NOLCOS’92 at Bordeaux, France; NOLCOS’95 at Taxoe City, USA; MTNS’96 at St. Louis, USA; NOLCOS’98 at Twente, The Netherlands; Differential Equations and Dynamical Systems, 2000, 2006, 2008, 2010, 2012 at Suzdal, Russia; Feedback and Optimal Control, 2003 at Siena, Italy; NOLCOS’04 at Stuttgart, Germany; IFIP TC7, 2005 at Turin, Italy; NOLCOS’07 at Pretoria, South Africa; Mathematical Control Theory: Controllability, Optimization, Stability, 2009 at Turin, Italy; New Trends in Sub-Riemannian Geometry, 2010 at Nice, France; trimester “Combinatorics and Control”, 2010 at Madrid, Spain; NOLCOS’10 at Bologna, Italy; several conferences in SISSA, Trieste, and many others.
- Co-director of the Summer Schools on Mathematical Control Theory and Dynamical Systems, 2001, 2013, 2016, 2019, ICTP, Trieste, Italy.
- Co-director of the European multi-partner Marie Curie Training Site, 2002 – 2006.
- Director of the Trimester on Dynamical and Control Systems, 2003, SISSA–ICTP, Trieste, Italy.

- National coordinator of the MIUR research projects in 2002 – 2003, 2005 – 2006, 2007 – 2008 and 2010 – 2011.
- Member of the scientific committee of the European Research Group project “Control of partial differential equations” started in 2010.
- Head of the research project “Geometric control theory and analysis on metric structures” supported by the Russian Federation, 2013 – 2015.
- Co-organizer of the Trimester “Geometry, analysis and dynamics on subriemannian manifolds”, 2014, Institute Henri Poincaré, Paris, France.
- Associate Editor of the SIAM Journal on Control and Optimization, 1993 – 1998.
- Editor-in-Chief of the Journal of Dynamical and Control Systems since 2003 (managing editor, 1995 – 2002); member of the editorial boards of other 5 journals.
- Member of the Board of the Moscow Mathematical Society, 1996 – 1998.
- Scientific consultant of the International Center for Theoretical Physics, Trieste, Italy, 2001 – 2003.
- Selected visiting positions: Institute for Mathematics and its Applications, Minneapolis, USA (Feb. – March 1993); University of Florence, Italy (Nov. 1994 – Feb. 1995, Nov. – Dec. 1996); Bourgogne University, France (May – July 1996, Oct. – Dec. 1997, Feb. – June 1998, May – July 1999); Institute Henri Poincaré, Paris, France (Jan. 1998, Fall 2014); International School for Advanced Studies, Trieste, Italy (Nov. – Dec. 1998, Feb. – Apr. 1999, Sept. 1999 – Jan. 2000); Mittag Lefler Institute, Sweden (March – Apr. 2003); University of Nice, France (April – May 2007, May – June 2008); Ecole Polytechnique, France (Fall 2013, Fall 2016 and Spring 2017); Sorbonne University, France (Oct. – Nov. 2021).
- Over 150 research papers on Control Theory, Optimization, Geometry, and the books:

- Control Theory from the Geometric Viewpoint, with Yu. Sachkov (Springer Verlag, 2004, xiv+412 pp.)
- Curvature: A variational Approach, with D. Barilari and L. Rizzi (Amer. Math. Soc., 2018, 142 pp.)
- A Comprehensive Introduction to Sub-Riemannian Geometry, with D. Barilari and U. Boscain (Cambridge Univ. Press, 2020, xviii+745 pp.)

### **Former Ph. D. students**

- Andrey Sarychev, 1980, Phys.-Tech. Univ., Moscow.
- Igor Zelenko, 2002, Technion, Haifa.
- Mario Sigalotti, 2003, SISSA, Trieste.
- Natalia Chtcherbakova, 2004, SISSA, Trieste.
- Thomas Chambrion, 2004, Univ. de Bourgogne, Dijon.
- Ulysse Serres, 2006, Univ. de Bourgogne, Dijon.
- Paolo Mason, 2006, SISSA, Trieste.
- Francesca Chittaro, 2007, SISSA, Trieste.
- Sergio Rodrigues, 2008, Univ. of Aveiro.
- Marco Caponigro, 2009, SISSA, Trieste
- Chengobo Li, 2009, SISSA, Trieste
- Francesco Rossi, 2009, SISSA, Trieste
- Roberta Ghezzi, 2010, SISSA, Trieste
- Antonio Lerario, 2011, SISSA, Trieste
- Davide Barilari, 2011, SISSA, Trieste
- Luca Rizzi, 2014, SISSA, Trieste

- Dario Prandi, 2014, SISSA, Trieste
- Alessandro Gentile, 2014, SISSA, Trieste
- Pavel Silveira Diaz, 2015, SISSA, Trieste
- Elisa Paoli, 2015, SISSA, Trieste
- Francesco Boarotto, 2016, SISSA, Trieste
- Carolina Biolo, 2017, SISSA, Trieste
- Khazhgali Kozhasov, 2018, SISSA, Trieste
- Ivan Beschastnyi, 2018, SISSA, Trieste
- Michele Stecconi, 2020, SISSA, Trieste
- Tommaso Rossi, 2021, Institut Fourier, Grenoble, & SISSA, Trieste

## Some Recent Papers

1. Tangent hyperplanes to subriemannian balls. *J. Dynamical and Control Systems*, 2016, v.22, 683–692
2. Sub-Riemannian curvature in contact geometry. *J. Geom. Anal.*, 2017, v.27, 366–408 (with D. Barilari and L. Rizzi)
3. Intrinsic random walks in Riemannian and sub-Riemannian geometry via volume sampling. *J. ESAIM:COCV*, 2018, v.24, 1075–1105 (with U. Boscain, R. Neel, L. Rizzi)
4. Volume geodesic distortion and Ricci curvature for Hamiltonian dynamics. *Annales de l’Institut Fourier*, 2019, v.69, 1187–1228 (with D. Barilari, E. Paoli)
5. Homotopically invisible singular curves. *Calculus of Variations and PDEs*, 2017, v.56, 1–34 (with F. Boarotto, A. Lerario)
6. Introduction to geodesics in sub-Riemannian geometry. In: Barilari D., Boscain U., Sigalotti M. (Eds), *Geometry, Analysis and Dynamics on sub-Riemannian manifolds*, v.II. EMS SERIES OF LECTURES IN MATHEMATICS, 2016, 1–83 (with D. Barilari, U. Boscain)

7. Ensemble controllability by Lie algebraic methods. *J. ESAIM:COCV*, 2016, v.22, 921–938 (with Yu. Baryshnikov, A. Sarychev)
8. Switching in time-optimal problem. The 3-D case with 2-D control. *J. Dynamical and Control Systems*, 2017, v.23, 577–595 (with C. Biolo)
9. Topics in subriemannian geometry. *Russian Math. Surveys*, 2016, v.71:6, 3–36
10. Switching in time-optimal problem with control in a ball. *SIAM J. on Control and Optimization*, 2018, v.56, 183–200 (with C. Biolo)
11. Symplectic geometry of constrained optimization. *Regular and Chaotic Dynamics*, 2017, v.22, 750–770 (with I. Beschastnyi)
12. Optimality of broken extremals. *J. Dynamical and Control Systems*, 2019, v.25, 289–307 (with C. Biolo)
13. Spectrum of the second variation. *Proceed. Steklov Math. Inst.*, 2019, v.304, 26–41
14. Jacobi Fields in optimal control: Morse and Maslov indices. *Nonlinear Analysis*, to appear (with I. Beschastnyi)
15. Jacobi fields in optimal control: one-dimensional variations. *J. Dynamical and Control Systems*, 2020, v.26, 685–732 (with I. Beschastnyi)
16. Normal forms for the endpoint map near nice singular curves for rank-two distributions. *J. ESAIM:COCV*, to appear (with F. Boarotto)
17. Chebyshev polynomials and best rank-one approximation ratio. *SIAM J. Matrix Anal. Appl.*, 2020, v.41, 308–331 (with K. Kozhasov and A. Uschmajew)
18. Control in the space of ensembles of points. *SIAM J. on Control and Optimization*, 2020, v.58, 1579–1596 (with A. Sarychev)
19. Control on the manifolds of mappings with a view to the deep learning. *J. Dynamical and Control Systems*, to appear (with A. Sarychev)
20. Ants and bracket generating distributions in dimensions 5 and 6. (with P. Nurowski)

21. Relative heat content asymptotics for sub-Riemannian manifolds. (with L. Rizzi and T. Rossi)