Curriculum Vitae

of

Yuri L. Sachkov

March 9, 2023

Personal Data

Born: November 23, 1964, in Dniepropetrovsk, USSR (now Ukraine).

Citizenship: Russia.

Country of permanent residence: Russia.

Address: Program Systems Institute, Russian Academy of Science, Pereslavl-Zalessky, Yaroslavskaya oblast, 152020 Russia.

E-mail: yusachkov@gmail.com

WWW home page: `http://control.botik.ru/?staff=sachkov`

Education: Doctor of Science in Mathematics (habilitation), Steklov Mathematical Institute, 2008, (reviewers Professors A.A.Agrachev, A.A. Melikyan, M.I.Zelikin), thesis title *"Controllability and optimal control for invariant control systems on Lie groups and homogeneous spaces"*,

Post-doctoral fellow, SISSA (Scuola Internazionale di Studi Avanzati), Trieste, Italy, 1999–2001 (supervisor Prof. A. A. Agrachev),

Doctorant, Steklov Mathematical Institute, 1998–1999 (consultant Prof. A. A. Agrachev),

Ph.D. in Mathematics, Moscow State University, 1992 (supervisor Prof. A. F. Filippov), thesis title *"Controllability of 3-dimensional bilinear systems"*,

M.S. in Mathematics, Moscow State University, 1986 (supervisor Prof. O.A. Oleinik), thesis title *"Generalized solutions to Laplace equation"*.

Foreign Languages: English (fluent), Italian (basic), Ukrainian (mother tongue).

Positions: Chief of Control processes research center, Program Systems Institute (PSI), Russian Academy of Sciences, since 2009.
Full Professor, Department of Mathematics, University of Pereslavl, since 2009.
Senior researcher, Program Systems Institute, Russian Academy of Sciences, 1995–2009.
Associate Professor, Department of Mathematics, University of Pereslavl, 1994–2009.
Researcher, PSI, 1993 – 1994.
Teacher, Department of Mathematics, University of Pereslavl, 1993 – 1994.
Junior researcher, PSI, 1989 – 1993.

Research Interests: Sub-Riemannian Geometry, sub-Finsler geometry, Right-Invariant Control Systems on Lie Groups, Optimal Control, Bilinear Systems, Nonlinear Geometric Control

Theory, Motion Planning, Applications to Robotics, Mechanics, and Reconstruction of Images, Integrability and Non-Integrability of Hamiltonian Systems, Numerical Methods for Optimal Control and ODEs, Parallel Computations.

Teaching Experience

Supervisor of PhD theses since 2007.

Defended PhD theses:

1. Elena Sachkova (Pereslavl-Zalessky, Russia, 2009),
   "Motion planning for nonlinear control system via nilpotent approximation",

2. Alexei Mashtakov (Pereslavl-Zalessky, Russia, 2012),
   "Optimal control of rolling bodies problems",

3. Andrey Ardentov (Pereslavl-Zalessky, Russia, 2012),
   "Left-invariant sub-Riemannian problem on Engel group",

4. Yasir Awais Butt (Islamabad, Pakistan, 2015),
   "Left-invariant sub-Riemannian problem on the group of hyperbolic motions of 2-dimensional plane".

 Current PhD students:

1. Alexey Podobryaev (Pereslavl-Zalessky, Russia, 2013–2017),
   "Left-invariant Riemannian geometry on the group of rotations of 3-dimensional space".

Various courses on Geometric Control Theory, Ordinary Differential Equations and Calculus in universities of Trieste, Rouen, Pereslavl, Brno, Brasov since 1997.

Adviser of bachelor and master theses, since 1996.

Research and Teaching Visits

Universities of Lille, Dijon, Augsburg, Coimbra, Aveiro, Trieste, Rouen, Milano, Brno, Eindhoven (since 1995).

Professional Activities

Managing Editor of *Journal of Dynamical and Control Systems*, Springer, since 2007.

Member of the Editorial Board of *Journal of Dynamical and Control Systems*, Springer, since 1996.

Member of the Editorial Board of *Regular and Chaotic Dynamics*, Springer, since 2016.

Member of the Editorial Board of *Journal of Mathematical Sciences*, Springer, since 2012.

Member of the Editorial Board of Journal *Program Systems: Theory and Practice*, since 2010.

Member of the American Mathematical Society.

Chief developer of web-site of the Mega-grant "Geometric control theory and analysis on metric structures", Principal investigator Andrei Agrachev (2013–2015).

Expert of the Russian Foundation for Basic research (since 2012).

Expert of the Russian Science Foundation (since 2017).

Grants

Numerous research grants from the Russian Foundation for Basic Research, INTAS, Russian Government, Landau Network — Centro Volta (Italy) (since 1995).

External collaborator in Mega-grant "Geometric control theory and analysis on metric structures", Principal investigator Andrei Agrachev (2013–2015)

Grant from Russian Science Foundation "Optimal Control on Lie Groups and its Applications to Computer Graphics, Robotics and Modeling of Vision" (2017–2019)

Conferences and Workshops Organized

1. Youth symposium with international participation "Control theory: new methods and applications", September 22-26, 2009, Pereslavl-Zalessky, Russia

2. International conference "Control and optimization of nonholonomic systems", July 8–13, 2011, Pereslavl-Zalessky, Russia

3. International conference "Mathematical control theory and mechanics", June 5–9, 2013, Suzdal, Russia

4. International youth school–workshop "Control and optimization of nonholonomic systems", June 10–13, 2013, Pereslavl-Zalessky, Russia

5. Thematic Day "Riemannian and sub-Riemannian geometry on Lie groups and homogeneous spaces" in the framework of IHP Trimester "Geometry, Analysis and Dynamics on Sub-Riemannian Manifolds", September 1 - December 12, 2014, Paris, France,

6. Workshop "Nonholonomic days in Pereslavl", August 6–8, 2015, Pereslavl-Zalessky, Russia

7. Session "Geometry and Control in Vision", International Workshop on Geometry, PDEs and Lie Groups in Image Analysis, 24–26 August 2016, Eindhoven, The Netherlands

8. Workshop "Mathematics in supercomputer era", Novemver 27, 2017, Pereslavl-Zalessky, Russia

Reviewer

Ph.D. and Doctor of Science theses, Moscow, Vladimir, Pereslavl-Zalessky (Russia), Rouen (France), since 2007.

French National Agency (ANR), 2014.

IEEE Control Systems Society Conference (CDC14), 2014.

Journal of Dynamical and Control Systems, Springer, since 1996.

SIAM Journal on Control and Optimization, since 2011.

Journal of Optimization Theory and Applications, since 2011.

Journal of Mathematical Sciences, Springer, since 2011.

Mathematical Reviews, American Mathematical Society, since 1999.

International Journal of Control, since 2000.

Russian Journal *Referativnij Zhurnal*, 1995–1996.

Applied Mathematics Letters journal, since 2009.

Sbornik Mathematics journal, since 2012.

Mathematical notes journal, since 2012.

ESAIM: Control, Optimisation and Calculus of Variations (ESAIM: COCV) journal, since 2013.

Discrete amd Continuous Dynamical Systems Ser. A journal, since 2014.

IEEE Transactions on Automatic Control, since 2010.

Automatica journal, since 2009

IMA Journal of Mathematical Control and Information, since 2009.

Automatics and Remote Control journal, since 2012.

Control of big systems journal, since 2013.

Differential equations journal, since 2014.

Russian foundation for basic research, since 2013.

Moscow State University grants for young researchers, since 2012.

Moebius competition for young researchers, Moscow, since 2013.

Conference on Mathematical Control and Mechanics, Suzdal, since 2009.

Russian-English Translator

Journal of Mathematical Sciences, Springer, since 2000.

Moscow University Mathematics Bulletin, Allerton Press, 1995–1999.

International workshops on control theory, Pereslavl-Zalessky, 1995–1999 (parallel translations of talks).

Books Edited

1. A. Bressan, B. Piccoli, *Introduction to the Mathematical Theory of Control* (Translation into Russian), Moscow-Izhevsk, Regular and chaotic dynamics, 2016

Publications

Textbooks and monographs

1. (with A.A. Agrachev) Control Theory from the Geometric Viewpoint, Springer-Verlag, 2004; *Russian version*: Geometric Control Theory, Moscow, Fizmatlit, 2005.

2. Controllability and symmetries of invariant systems on Lie groups and homogeneous spaces (in Russian), Moscow, Fizmatlit, 2007.

3. (with Remco Duits, Arpan Ghosh, Tom Dela Haije) Cuspless Sub-Riemannian Geodesics within the Euclidean Motion Group SE(d), Chapter in a book *Neuromathematics of Vision Lecture Notes in Morphogenesis* (Editors G. Citti, A. Sarti), Springer, 2014, pp 173–215.

4. Introduction to geometric control, Springer, 2022.

Papers in Reviewed Journals

1. Controllability of 3-dimensional Bilinear Systems, *Vestnik Moskovskogo Universiteta, Ser. Math. Mech.*, (1991), 3: 26–30 (in Russian, translated into English in *Moscow University Mathematics Bulletin*).

2. Invariant Domains of 3-dimensional Bilinear Systems, *Vestnik Moskovskogo Universiteta, Ser. Math. Mech.*, (1991), 4: 23–26 (in Russian, translated into English in *Moscow University Mathematics Bulletin*).

3. Positive Orthant Controllability of 2-dimensional and 3-dimensional Bilinear Systems, *Differentcialnije Uravnenija*, (1993), 2: 361–363 (in Russian, translated into English in *Differential Equations*).

4. Positive Orthant Controllability of Single-input Bilinear Systems, *Mat. zametki*, **85** (1995), 3: 419–424 (in Russian, translated into English in *Mathematical Notes*).

5. Invariant Orthants of Bilinear Systems, *Differentcialnije uravnenija*, **31** (1995), 6: 1094–1095 (in Russian, translated into English in *Differential equations*).

6. Controllability of Hypersurface and Solvable Invariant Systems, *Journal of Dynamical and Control Systems*, **2** (1996), 1: 55–67.

7. Controllability of Affine Right-Invariant Systems on Solvable Lie Groups, *Discrete Mathematics and Theoretical Computer Science*, **1** (1997), 239–246.

8. On Positive Orthant Controllability of Bilinear Systems in Small Codimensions, *SIAM Journ. Control and Optimization*, **35** (1997), 1: 29–35.

9. Controllability of Right-Invariant Systems on Solvable Lie Groups, *Journal of Dynamical and Control Systems*, **3** (1997), 4: 531–564.

10. On Invariant Orthants of Bilinear Systems, *Journal of Dynamical and Control Systems*, **4** (1998), 1: 137–147.

11. Classification of controllable systems on low-dimensional solvable Lie groups, *Journal of Dynamical and Control Systems*, **6** (2000), 2: 159–217.

12. Exponential mapping in the generalized Dido problem (in Russian), *Matem. Sbornik*, **194** (2003), 9: 63–90. English translation: *Sbornik: Mathematics* (2003), 194(9):1331–1360.

13. Symmetries of Flat Rank Two Distributions and Sub-Riemannian Structures, *Transactions of the American Mathematical Society*, **356** (2004), 2: 457–494.

14. Discrete symmetries in generalized Dido's problem, *Sbornik: Mathematics*, 197 (2006), 2: 235–257.

15. The Maxwell set in the generalized Dido problem, *Sbornik: Mathematics*, 197 (2006), 4: 595–621.

16. Complete description of the Maxwell strata in the generalized Dido problem, *Sbornik: Mathematics*, 197 (2006), 6: 901–950.

17. Optimality of Euler's elasticae (in Russian), *Doklady Mathematics*, Vol. 76 (2007), No. 3, 817–819.

18. Maxwell strata in Euler's elastic problem, *Journal of Dynamical and Control Systems*, Vol. 14 (2008), No. 2 (April), 169–234.

19. Conjugate points in Euler's elastic problem, *Journal of Dynamical and Control Systems*, 2008 Vol. 14 (2008), No. 3 (July), 409–439.

20. (with A. Ardentov) Solution of Euler's elastic problem (in Russian), *Avtomatika i Telemekhanika*, 2009, No. 4, 78–88. (English translation in *Automation and remote control*.)

21. (with A. Ardentov, V. Kasimov, A.Mashtakov) Reconstruction of images via variational principle (in Russian), *Program products and systems*, 2009, No. 4, 126–127.

22. (with A. Ardentov) Parallel algorithms and programs for modeling of Euler elasticae (in Russian), *Program products and systems*, 2009, No. 4, 71–73.

23. (with I. Moiseev) Maxwell strata in sub-Riemannian problem on the group of motions of a plane, *ESAIM: COCV*, 16 (2010), 380–399.

24. Conjugate and cut time in the sub-Riemannian problem on the group of motions of a plane, *ESAIM: COCV*, 16 (2010), 1018–1039.

25. Symmetries and Maxwell strata in the ball-plate problem, *Sbornik Mathematics*, V. 201 (2010), N 7, 1029–1091.

26. (with S. Levyakov) Stability of Euler elasticae centered at vertices or inflection points, *Proceedings of the Steklov Institute of Mathematics*, V. 271 (2010), 187–203.

27. Cut locus and optimal synthesis in the sub-Riemannian problem on the group of motions of a plane, *ESAIM: COCV*, 17 (2011), 293–321.

28. (with A.Ardentov) Extremal trajectories in nilpotent sub-Riemannian problem on Engel group, *Sbornik Mathematics*, 202 (2011), No. 11, 31–54. English translation: *Sbornik: Mathematics* (2011), 202(11):1593–1616.

29. (with A. Mashtakov) Extremal trajectories and Maxwell points in the plate-ball problem, *Sbornik Mathematics*, 202 (2011), No. 9, 97–120.

30. Closed Euler Elasticae, *Proceedings of the Steklov Institute of Mathematics*, V. 278 (2012), 218–232.

31. (with A.Ardentov, I.Beschastnyj, A.Mashtakov) Interface for study of sub-Riemannian geodesics on 3D Lie groups, *Program Products and Systems*, 2012, No. 4, pp. 200–203.

32. (with A.Ardentov, A.Mashtakov) Parallel Algorithm and Software for Image Inpainting via Sub-Riemannian Minimizers on the Group of Rototranslations, *Numer. Math. Theor. Meth. Appl.*, 2013, Vol. 6, No. 1, pp. 95-115.

33. (with A.Ardentov) Conjugate points in nilpotent sub-Riemannian problem on the Engel group, *Journal of Mathematical Sciences*, Vol. 195, No. 3, December, 2013, 369–390. `arXiv:1209.2865v1 [math.OC] 13 Sep 2012`

34. (with M.G.Dmitriev) Asymptotics of sub-Riemannian geodesics in a curve reconstruction problem, *Differential equations*, (in Russian), vol. 49 (2013), No. 11, 1381–1389.

35. (with Y.A.Butt, A.I. Bhatti) Parametrization of Extremal Trajectories in Sub-Riemannian Problem on Group of Motions of Pseudo Euclidean Plane, *Journal of Dynamical and Control Systems*, Vol. 20 (2014), No. 3 (July), 341–364.

36. (with U. Boscain, R. Duits, F. Rossi) Curve cuspless reconstruction via sub-Riemannian geometry, *ESAIM: Control, Optimisation and Calculus of Variations*, 20 (2014), 748–770.

37. (with U. Boscain, R. Duits, F. Rossi) Association fields via cuspless sub-Riemannian geodesics in SE(2), *J Math Imaging Vis*, June 2014, Volume 49, Issue 2, pp 384–417.

38. (with E.Sachkova) Exponential mapping in Euler's elastic problem, *Journal of Dynamical and Control Systems*, Vol. 20 (2014), No. 4, 443–464.

39. (with A. Mashtakov), Integrability of sub-Riemannian structures on special linear group $SL_2(R)$, Differential equtions, 2014, No. 11, 1541–1547

40. (with J.-P. Gauthier) On the free Carnot $(2, 3, 5, 8)$ group, *Program systems: theory and applications*, 2015, 6:2(25), 45–61.

41. (with A. A. Ardentov) Cut time in sub-Riemannian problem on Engel group, *ESAIM: Control, Optimisation and Calculus of Variations*, 21 (2015), 958–988. `arXiv:1408.6651`

42. (with A. Mashtakov) Superintegrability of Sub-Riemannian Problems on Unimodular 3D Lie Groups, *Differential equations*, 51 (2015), No. 11, pp. 1476—1483.

43. (with Qihui Cai, Tiren Huang, Xiaoping Yang) Geodesics in the Engel group with a sub-Lorentzian metric, *Journal of Dynamical and Control Systems*, Vol. 22 (2016), 465–484.

44. (with I.Yu. Beschastnyi), Geodesics in the sub-Riemannian problem on the group SO(3), *Sbornik Math.* 2016, 207 (7), 29--56

45. (with Ya. Butt, A.I. Bhatti), Maxwell strata and conjugate points in sub-Riemannian problem on the group SH(2), *Journal of Dynamical and Control Systems*, 22 (2016), 747–770

46. (with A.Podobryaev), Cut locus of a left invariant Riemannian metric on SO(3) in the axisymmetric case, *Journal of Geometry and Physics*, 110 (2016) 436–453.

47. (with A. Mashtakov, A. Ardentov) Relation between Euler's Elasticae and Sub-Riemannian Geodesics on SE(2), *Regular and Chaotic Dynamics*, December 2016, Volume 21, Issue 7, pp 832–839.

48. (with Ya. Butt and A.I. Bhatti), Cut Locus and Optimal Synthesis in Sub-Riemannian Problem on the Lie Group SH(2), *Journal of Dynamical and Control Systems*, 23 (2017), 155–195

49. (with E.Sachkova) Degenerate abnormal trajectories in the sub-Riemannian problem with the growth vector $(2, 3, 5, 8)$, *Differential equations* (in Russian), 2017, No. 3, 362–374.

50. (with L.Lokutsievskii) Liouville nonintegrability of sub-Riemannian problems on free Carnot groups of step 4, *Doklady Mathematics* (2017) 95: 211—213

51. (with A. P. Mashtakov, Remco Duits, Erik Bekkers, I. Yu. Beschastnyi) Sub-Riemannian geodesics in SO(3) with application to vessel tracking in spherical images of retina, *Dokl. Math.* (2017) 95: 168–171

52. (with A.Podobryaev) Left-invariant Riemannian problems on the groups of proper motions of hyperbolic plane and sphere, *Dokl. Math.* (2017) 95: 176—177

53. (with A.A. Ardentov) Maxwell Strata and Cut Locus in the Sub-Riemannian Problem on the Engel Group, Regular and Chaotic Dynamics, December 2017, Vol. 22, Issue 8, pp 909–936.

54. (with A. Mashtakov, R. Duits, E. Bekkers) Tracking of Lines in Spherical Images via Sub-Riemannian Geodesics in SO(3), *Geometric Science of Information*, Lecture Notes in Computer Science 10589, Springer, 2017, 782–790.

55. (with L.V.Lokutsievsky), On Liouville integrability of sub-Riemannian problems on Carnot groups of step 4 and more, Sbornik mathematics 209:5 (2018), 74–119

56. (with A. V. Podobryaev) Symmetric Riemannian Problem on the Group of Proper Isometries of Hyperbolic Plane, J Dyn Control Syst (2018) 24: 391

57. (with A.A. Ardentov) Cut Locus in the Sub-Riemannian Problem on Engel Group, Doklady Mathematics, January 2018, Vol. 97, Issue 1, pp 82–85.

58. Optimal bang-bang trajectories in sub-Finsler problem on the Cartan group, Russian Journal of Nonlinear Dynamics, 2018, vol.4, n.4, 583-593.

59. (with A.Ardentov, Tiren Huang, Xiaoping Yang), Extremals in the Engel group with a sub-Lorentzian metric, *Sbornik: Mathematics*, accepted, 2018.

60. (with A.Ardentov, E. Le Donne), Extremal trajectories in sub-Finsler problem on the Cartan group, Proc. Steklov Math. Inst., v. 304 (2019), 49–67.

61. (with A.Ardentov), sub-Finsler problem on the Cartan group, Doklady mathematics, 2019, 484, No. 2, 138-141

62. (with A.Ardentov, E. Le Donne), Sub-Finsler problem on the Cartan group, Regular and Chaotic Dynamics, 2019, vol. 24, no. 1, pp. 36-60.

63. (with A.Ardentov), Sub-Finsler structures on the Engel group, Doklady mathematics, 2019, 485, No. 4, 395—398

64. (with E.F. Sachkova), Symmetries and Parameterization of Abnormal Extremals in the Sub-Riemannian Problem with the Growth Vector (2, 3, 5, 8), Russian Journal of Nonlinear Dynamics, 2019, vol. 15, no. 4, pp. 579–587

65. Yu. L. Sachkov, Periodic controls in step 2 strictly convex sub-Finsler problems, Regular and Chaotic Dynamics, 2020, Vol. 25, No. 1, pp. 33—39.

66. Periodic time-optimal controls on two-step free nilpotent Lie groups, Doklady mathematics, 2020, 492, p. 108—111

67. Yu. L. Sachkov, Optimal Bang-Bang Trajectories in Sub-Finsler Problems on the Engel Group, Russian Journal of Nonlinear Dynamics, 2020, vol. 16, no. 2, pp. 355—367

68. (with E.F. Sachkova), Structure of abnormal extremals in the sub-Riemannian problem with the growth vector (2, 3, 5, 8), Sbornik mathematics, 211 (2020), No. 10, 112—138.

69. Conjugate points in the generalized Dido's problem, Math. Notes, 108:5 (2020), 762–764

70. (with A.Ardentov, L. Lokutsievskiy), Solution to classical optimal control problems with 2-dimensional control on the basis of convex trigonometry, Doklady mathematics, 2020, 494, 86–92

71. Bang-Bang Extremals in Sub-Finsler Problems on Engel Group, Proceedings of 2020 15th International Conference on Stability and Oscillations of Nonlinear Control Systems (Pyatnitskiy's Conference) (STAB), Moscow, 3-5 June 2020, IEEE

72. Coadjoint orbits and time-optimal problems for two-step free nilpotent Lie groups, Math. notes, 108:6 (2020), 899–910 DOI: https://doi.org/10.4213/mzm12822

73. (with E.F. Sachkova), Sub-Riemannian (2,3,5,6)-structures, Doklady mathematics, 2021, 496, 73–78

74. A. Ardentov, G. Bor, E. Le Donne, R. Montgomery, Yu. L. Sachkov, Bicycle paths, elasticae and sub-Riemannian geometry, Nonlinearity 34 (2021) 4661–4683 https://doi.org/10.1088/1361-6544/abf5bf

75. A.A. Ardentov, L.V. Lokutsievskiy, Yu.L. Sachkov, Extremals for a series of sub-Finsler problems with 2-dimensional control via convex trigonometry, ESAIM: COCV 27 (2021) 32, 1—52 https://doi.org/10.1051/cocv/2021024

76. Sachkov, Y.L. Conjugate Time in the Sub-Riemannian Problem on the Cartan Group. J Dyn Control Syst 27, 709–751 (2021). https://doi.org/10.1007/s10883-021-09542-5

77. (with E.F. Sachkova), Abnormal set for (2,3,5,8)-distribution, Math. notes, 109:2 (2021), 318–320

78. Homogeneous sub-Riemannian geodesics on the group of motions of the plane, Differential equations, 2021, vol. 57, No. 11, 1568–1572 DOI: 10.31857/S0374064121110145

79. (with E.F. Sachkova), Carnot algebras and sub-Riemannian structures with growth vector (2,3,5,6), Optimal control and differential games, Collected papers, Proceedings of Steklov mathematical institute, 315, 2021, 237–246 DOI: https://doi.org/10.4213/tm4221

80. (with A. Popov), Sub-Riemannian Engel sphere, Doklady mathematics, 2021, vol. 500, 97–101

81. Left-invariant optimal control problems on Lie groups: classifications and problems integrable by elementary functions, Russian math. surveys, 77:1(463) (2022), 109–176

82. Sub-Riemannian Cartan sphere, Doklady mathematics, 2022, vol. 507, 66–70

83. Yu. L. Sachkov, E. F. Sachkova, Sub-Lorentzian Problem on the Heisenberg Group, Math. Notes, 113:1 (2023), 160–163

84. Left-invariant optimal control problems on Lie groups: problems integrable by elliptic functions, Russian math. surveys, 78:1(469) (2023), 67–166

Survey Works

1. Survey on Controllability of Invariant Systems on Solvable Lie Groups, in: *Differential Geometry and Control*, Proceedings of the AMS Summer Research Institute on Differential Geometry and Control, Boulder, USA, July 1997, Proceedings of Symposia in Pure Mathematics, **64** (1999), 297–317.

2. Controllability of Invariant Systems on Lie Groups and Homogeneous Spaces, in: *Progress in Science and Technology, Series on Contemporary Mathematics and Applications, Thematical Surveys*, Vol. 59, *Dynamical Systems-8*, All-Russian Institute for Scientific and Technical Information (VINITI), Ross. Akad. Nauk, Moscow, 1998; English transl: *J. Math. Sci.*, v. 100, No. 4, 2000, 2355–2427.

Lecture Notes and Tutorial Works

1. Control Theory on Lie Groups, *Journal of Mathematical Sciences*, Vol. 156, No. 3, 2009, 381-439.

2. (with E.F. Sachkova) *Limits of univariate functions. Infinitesimals*, University of Pereslavl, 2002 (in Russian).