Igor Zelenko
CURRICULUM VITAE

Name: Igor Zelenko
Citizenship: dual US and Israeli citizenship.
Marital status: married +2
Home address: 1110 Waynesboro Ct, College Station, TX, 77845, USA
Work address: Department of Mathematics, Mailstop 3368, Texas A&M University College Station, TX 77843-3368
Phones: +1-979-690-7039(home), +1-979-820-0620 (work)
e-mail: zelenko@math.tamu.edu (equivalently, zelenkotamu@tamu.edu)
Personal homepage: https://people.tamu.edu/$\sim$ zelenkotamu//

Education:

- PhD in Mathematics, Technion- Israel Institute of Technology, June 2002

  PhD thesis title: *Invariants of curves in the Lagrange Grassmannian and differential geometry of smooth control systems.*

  Supervisors: Alexander Ioffe, Andrei Agrachev.

- Master in Mathematics, Technion - Israel Institute of Technology, 1998

  Master thesis title: *Nonregular abnormal geodesics of 2-distribution: existence, second variation and rigidity*

  Supervisor: Michael Zhitomirskii.

- BA degree, summa cum laude, Technion - Israel Institute of Technology, 1994

Military service: 1994-1996 (Israel Defense Forces)

Professional experience:

- Professor at the Department of Mathematics, Texas A&M University, College Station, USA- September 2023 till present.

- Associate Professor at Department of Mathematics, Texas A&M University, College Station, USA- August 2015 till present.

- Tenure-track Assistant Professor at Department of Mathematics, Texas A&M University, College Station, USA- August 2008-August 2015.

- A long term Visiting Associate Professor at International School for Advanced Studies (SISSA-ISAS), Trieste, Italy - September 2005-August 2008.

- Research Associate at International School for Advanced Studies (SISSA-ISAS), Trieste, Italy - August 2002 -August 2005.

Research subjects Differential geometry and Geometric Control Theory.

The main direction of my current research is the construction of canonical frames and differential invariants for a wide class of geometric structures and control systems on manifolds, especially for

- nonholonomic vector distributions (vector subbundles of tangent bundles), affine control systems, fields of cones with application to state-feedback equivalence of control system, geometry of variational problems, CR-structures (especially degenerate ones), system of ODE's and PDE's (including systems of mixed order);

- sub-Riemannian and sub-Finslerian structures on nonholonomic vector distributions with application to Optimal Control, Neuroscience (study of human motions) and Physics (for example, to Yang-Mills fields). Especially I am interested in studying

  - Projective and affine equivalence of sub-Riemannian metrics;
  - Various type of Comparison Theorems in sub-Riemannian Geometry in terms of the curvature type invariants.

The approach to these equivalence problems is based on combination of several techniques: symplectification/linearization of the problem (taking its origin in Control Theory), the Tanaka prolongation procedure for filtered structures on manifold and its generalizations, and the Tanaka like prolongation theory for differential geometry of natural classes of curves of flags in parabolic and more general homogeneous spaces. Using this and other approaches I also work on the following topics:

- global existence of distributions with prescribed properties of the brackets of their sections via the methods of h-principle.

- inverse Wronski problem and more general Schubert problems in real algebraic geometry;

- Morse theory for branches of eigenvalues of families of symmetric and hermitian matrices

- qualitative study of Hamiltonian systems (via the notion of generalized curvature of Hamiltonian systems).

- nilpotent approximation of singular distributions and control systems near singular points;

- sub-Riemannian analogs of Laplace-Beltrami operator, asymptotic of the corresponding heat kernels, and index of sub-elliptic operators;

- optimal control and stabilization in save vehicle platooning;

- application of algebraic geometry in network coding;

- singularities of caustics and wave fronts, appearing in sub-Riemannian Geometry;

- invariant description of flat control systems.

Current Grants:

1. NSF Grant, "Geometry and topology of nonholonomic structures" (PI), Division of Mathematical Sciences (DMS), DMS 2105528, award amount of $235,306, March 1 2022- February 28, 2025; This grant covers 1.5 month of summer support for 1 graduate students each year.

2. Simons Foundation Collaboration Grant for Mathematicians, number 524213, "Geometry of nonholonomic structures on manifolds", award amount of $42,000, September 1, 2017-August 31 2022 with non-cost extension to August 2024.

3. co-PI in NSF Grant "Texas Geometry and Topology Conference", DMS 1812040, (PI J.M. Landsberg, co-PI D. Baskin) award amount $90,000, May 2018-April 2023.

Past Grants:

1. NSF Grant "Geometry and Analysis of Nonholonomic structures on Manifolds", DMS 1406193, award amount of $130,188, September 1, 2014-August 31, 2017. I was the Principal and the only Investigator in this project.

2. Grant (jointly with A. Agrachev, S. Ignatovich, M. Kawski, and P. Mormul) for the Research in Team project entitled ""Gradations and nilpotentizations of control systems" in the frame of Trimester in "Control and Combinatorics", Madrid, April-June 2010 (2,500 Euro, from the organizers of this activity supported by Spanish National Research Council (CSIC));

3. Research Grants from Italian Ministry of Education and Science (MIUR) for the group of Geometric Control at SISSA/ISAS (jointly with A. Agrachev (main coordinator), U. Boscain, B. Piccoli. C. Altafini and others)

   - COFIN 2001, the Italian MURST research project: "Feedback control and optimal control". Duration: 24 months. Total budget: 154, 937 Euro.
   - PRIN 2004, the Italian MIUR research project: "Control, Optimization and Stability of Nonlinear Systems: Geometric and Analytic Methods" Duration: 24 months. Total budget: 137, 200 Euro.
   - PRIN 2006, the Italian MIUR research project: "Mathematical Control Theory: Controllability, Optimization, Stability". Duration: 24 months. Total budget: 81, 003 Euro.

4. The grant of Central European Initiative (CEI) for organization of the workshop "Geometry of vector distributions, differential equations, and variational problems" during the year 2006: 6,000 Euro;

5. The grant of Central European Initiative (CEI) for partially supporting a half-year post-doctoral positions in SISSA in the year 2008: 7,000 Euro (the proposal was written by me and it was granted to Josef Silhan from Czech Republic, who visited me at SISSA in Spring 2008);

Past fellowships

1. Marie Curie Control Training Site (CTS) fellowship - it was used by me in February-April 2002, to visit SISSA, Trieste, Italy;

2. European Training and Mobility Research fellowships - it was used by me to visit SISSA, Trieste, Italy in September- December 1999 (paid by Rome University "La Sapienza") and in September-October 2001 (paid by University of Florence);

3. I was supported by Binational Israel-USA Science Foundation (BSF) grant (of R. Montgomery and M. Zhitomirskii)-1994-1997, I was included as a researcher in this project.

PhD students graduated under my supervision:

1. **Zaifeng Lin**, TAMU, August 2023, expected graduation May 2023. His thesis was about the analog of De Rham decomposition theorem in sub-Riemannian geometry (papers [1] accepted for publication and paper [53] in preparation). He is currently a researcher at Research Institute at China Telecom, Guangzhou, China.

2. **David Sykes**, TAMU, May 2021 (the papers [2], [3], and [7] are parts of his thesis and [59] in plan . He is currently a postdoc at Masaryk University, Brno, Czech Republic and will start his second postdoctoral position at Center of Complex Geometry, Institute for Basic Studies (IBS), Daejeon, Republic of Korea

3. **Sofya Maslovskaya**, ENSTA ParisTech October 2018 (jointly with F. Jean). The title of the thesis is "Inverse Optimal Control: Theoretical Study", she is currently a postdoc at Paderborn University, Germany. The materials of published papers [6], [8] and [10] was a part of her thesis.

4. **Curtis Porter**, TAMU, August 2016 (jointly with JM Landsberg) . PhD thesis title "The local equivalence problem for 7-dimensional , 2 non-degenerate CR manifolds whose cubic form is of conformal unitary type". He hed postdoctoral positions at North Carolina State University and at the Duke University, joint paper [4], a paper in preparation [51], and a paper in plan [59];

5. **Chengbo Li**, SISSA on October 2009 (jointly with A. Agrachev), PhD thesis title: "*Parametrized Curves in Lagrange Grassmannians and sub-Riemannian Geometry*", He is currently an Associate Professor at Tianjin University, China. We published four joint papers ([13], [21], [26], [27]).

6. I was a co-chair of graduate committee of a PhD student **Juan P. Gomez Constante** from Department of Mechanical Engineering, TAMU, defended his thesis in May 2018 (chair: K. Rajagopal), He was a Visiting Assistant Professor in the same department at least until 2020.

7. I was a co-chair of PhD graduate committee of a PhD student **Sina Arefizadeh** from Department of Civil Engineering, TAMU, the student left the program due medical problems. The material of preprint [43] below was planned to be a part of his thesis, but he stopped due health problems.

Current PhD Students under my supervision

1. I started to advise **Nick Day** from Fall 2021. We prepare a jint paper [56] and work toward a paper [60] in plan .

2. I started to advise **Christopher Sinkule** (in process of forming the graduate committee with me being the chair). We work toward a paper [61] in plan.

3. I am a cochair of graduate committee of **Milan Jovanovic** (chair is Dr. Zhizhang Xie), who previously made undergraduate research with me (see the section "Supervision of undergraduate research below"). He is currently the second year Ph. D. student in our department and we continue this project.

Ph.D. students for whom I was a non-official supervisor

This means I significantly participated in their mentoring during their Ph.D. studies, but was not officially a supervisor/co-supervisor, or I am currently advising them but is not yet a chair of their graduate committee.

1. I was a co-supervisor (non-officially) of **Natalia Chtcherbakova**, who defended her PhD thesis "Curvature-type invariants of geometrical control theory in problems of Hamiltonian dynamic" at SISSA in 2004 (our joint paper with her and A. Agrachev (see [34] below) was a part of her thesis).

2. I collaborated and mentored PhD students **Muxi Yan** working under supervision of Prof. Alex Sprintson from TAMU Department of Electrical and Computer Engineering on some problems in network coding (graduated in Spring 2016). We published paper [18].

3. I was a co-supervisor (non-officially) of **Wojciech Krynski**, who defended his PhD thesis in Spring 2008 at Banach Mathematical Center, Poland. We have written a joint paper [22], part of which was included in his PhD thesis.

Master and Diploma students graduated under my supervision:

1. **Haoshen Li** Master degree with thesis: May 2023. The title of the thesis: *"On left-invariant rank 2 distributions with zero generalized Wilczynski invariants on 6-dimensional Lie groups"* The paper [54] in preparation in preparation is a generalization of this thesis. Another joint paper in preparation [55] is on another project.

2. **Yanhe Huang**, Master degree with thesis at Texas A&M University (defended in Spring 2016), later defended the PhD at Department of Mathematics at UC Berkeley, and currently works at Google California. The title of the thesis: *"Injectivity properties of generalized Wronski maps"*. The published papers [5] and paper [9] are based on her Master thesis.

3. **Eric Wendel**, toward his Master degree with thesis at Texas A&M University, August 2016. Currently The title of the thesis *"On maximality of class of rank 2 distribution with 5 dimensional cube"* . He is currently a PhD Student in System Engineering at the Boston University A paper in plan based on his thesis is [62] below.

4. **E. A. Kwessi Nyandjou** - Diploma program of ICTP- International Center for Theoretical Physics, Trieste, Italy in the academic year of 2006/2007. He is currently a **Full Professor** in the Department of Mathematics at Trinity University, San Antonio. The title of his diploma thesis was "Generalized Sturm Theorem for self-adjoint differential operators of higher order".

5. **Y. Roodgar Amoli**- the Diploma program of ICTP- International Center for Theoretical Physics, Trieste, Italy in the academic year of 2005/2006. The title of his diploma thesis was "On quaternionic model and symmetries of vector distributions generated by rolling of spheres".

6. **Andrew Castillo** Fast track Master degree without thesis, TAMU 2015 , oral presentation was about projective equivalence of Riemannian and sub-Riemannian metrics.

7. I was a chair of **Grace Meek** toward her Master degree (without thesis) at TAMU on-line Master program; she successfully passed the final exam on July 8 2022; her topic of presentation was Routh-Hurwitz algorithm.

8. I was a chair of graduate committee of **Daum Yoon** toward his Master degree (without thesis) (graduated in May 2017 at Texas A&M University);

9. I was a chair of graduate committee of **Ryan Michael Causey** toward his Master degree (without thesis) (graduated in May 2011 at Texas A&M University).

Participation in Graduate committees:

1. I was a member of various PhD and Master graduate committee at the Department of Mathematics, and also of Economics, Aerospace Engineering, and Mechanical Engineering of Texas A&M University.

2. I was a member of the Ph.D. committee of Stefano Baranzini (including writing the report on his thesis) , graduate at International School for Advanced Studies (SISSA-ISAS), Trieste, Italy in October 2022

3. I am a member of the Ph.D. committee of Yaroslav Frolik (oncluding writing opponency report on his thesis), which is expected to graduate from Brno University of Technology, Brno , Czech Republic by Aufust 2024.

Supervision of undergraduate research

1. I supervised the undergraduate research of **Milan Jovanovic** during his senior undergraduate year 2020/2021 on the project of application of the method of complex integration in the h-principle theory for the proof of global existence of distribution with prescribed differential relations on manifolds. We are preparing paper [50].

2. I supervised the undergraduate research of a senior undergraduate student **Agam Shayit** on the project of finding compatibility condition for existence of a pseudo-Riemannian metric satisfying the Einstein equation with incompressible fluid stress energy tensor with application to cyclic cosmology.

3. I supervised **Matthew Kroesche** on a problem in quantum information theory in Fall 2017.

List of published and accepted papers:

1. (jointly with Zaifeng Lin) *On Eisenhart's type theorem for sub-Riemannian metrics on step* 2 *distributions with* ad-*surjective Tanaka symbols*, Regular and Chaotic Dynamics, Springer, accepted for publication, arxiv version arXiv:2308.14218, 38 pages.

2. (jointly with David Sykes) *On geometry of 2-nondegenerate CR structures of hypersurface type and flag structures on leaf spaces of Levi foliations*, Advances in Mathematics, Volume 413, 2023, 108850, ISSN 0001-8708, https://doi.org/10.1016/j.aim.2022.108850, 65 pages. (journal version), arxiv version arXiv:2010.02770 [math.CV].

3. (jointly with David Sykes) *Maximal dimension of groups of symmetries of homogeneous 2-nondegenerate CR structures of hypersurface type with a 1-dimensional Levi kernel*, Transformation Groups, published on-line June 2022, DOI 10.1007/s00031-022-09739-3, 30 pages, extended version in arXiv:2102.08599[math.CV], 38 pages.

4. (jointly with Curtis Porter) *Absolute parallelism for 2-nondegenerate CR structures via bigraded Tanaka prolongation*, J. Reine Angew. Math. 777 (2021), 195–250.

5. (jointly with Yanhe Huang, George Petroulakis, and Frank Sottile) *Nontrivial linear projections of the Grassmannian* $Gr_3(C^6)$, Linear Algebra Appl. 610 (2021), 488-505.

6. (jointly with Frederic Jean and Sofya Maslovskaya) *On Weyl's type theorems and genericity of projective rigidity in sub-Riemannian Geometry*, Geometriae Dedicata, Geom Dedicata 213, 295–314 (2021), https://doi.org/10.1007/s10711-020-00581-z.

7. (jointly with David Sykes) *A canonical form for pairs consisting of a Hermitian form and a self-adjoint antilinear operator,* Linear Algebra Appl. 590 (2020), 32–61.

8. (jointly with F. Jean and S. Maslovskaya) *On projective and affine equivalence of sub-Riemannian metrics*, Geometriae Dedicata, 203 (2019), 279–319.

9. (jointly with Y. Huang and F. Sottile) *Injectivity of generalized Wronski map*, Canad. Math. Bull. 60 (2017), no. 4, 747–761.

10. (jointly with F. Jean and S. Maslovskaya) *Inverse Optimal Control Problem: the Sub-Riemannian Case*, IFAC (International Federation of Automatic Control)-PapersOnLine, vol. 50, pp. 500–505, 2017.

11. (Jointly with N. Hein and F. Sottile) *A congruence modulo four for real Schubert calculus with isotropic flags*, Canad. Math. Bull. 60 (2017), no. 2, 309–318.

12. *Control of nonholonomic systems: from sub-Riemannian geometry to motion planning*[book review of MR3308372]. Bull. Amer. Math. Soc. (N.S.) 53 (2016), no. 1, 151–158.

13. (Jointly with P.W. Lee and C. Li) *Ricci curvature type lower bounds for sub-Riemannian structures on Sasakian manifolds*, Discrete and Continuous Dynamical Systems - Series A, Volume 36, Issue 1, 2016, 303–321, arxiv version (entitled Measure contraction properties of contact sub-riemannian manifolds with symmetry), arXiv:1304.2658 v1 [math. DG], 29 pages.

14. (Jointly with B. Doubrov) *Geometry of rank 2 distributions with nonzero Wilczynski invariants*, J. Nonlinear Math. Phys. 21 (2014), no. 2, 166-187; a longer version of the paper appears in arXiv:1301.2797 v1[math. DG], 27 pages.

15. (Jointly with N. Hein and F. Sottile) *A congruence modulo four in real Schubert calculus*, Journal für die reine und angewandte Mathematik (Crelle), J. Reine Angew. Math. 714 (2016), 151–174.

16. (Jointly with B. Doubrov) *Symmetries of trivial systems of ODEs of mixed order*, Differential Geom. Appl. 33 (2014), suppl., 123–143, arXiv:1302.7119 v1 [math. DG], 28 pages.

17. (Jointly with B. Doubrov) *On geometry of affine control systems with one input,* in the book " Geometric Control Theory and sub-Riemannain Geometry", G. Stefani, U. Boscain, M. Sigalotti, J.-P. Gauthier, A. Sarychev (Eds.), 133–152, Springer INdAM Ser., 5, Springer, Cham, 2014.

18. (Jointly with A. Sprintson and M. Yan) *Weakly secure data exchange with Generalized Reed Solomon codes*, 2014 IEEE International Symposium on Information Theory (ISIT), 2014, pp. 1366 - 1370.

19. (Jointly with B. Doubrov) *Geometry of curves in generalized flag varieties* , Transformation Groups 18 (2013), no. 2, 361-383.

20. (Jointly with B. Doubrov) *On geometry of curves of flags of constant type*, Cent. Eur. J. Math., 2012, 10(5), 1836-1871.

21. (Jointly with Chengbo Li) *Jacobi Equations and Comparison Theorems for Corank 1 sub-Riemannian Structures with Symmetries*, Journal of Geometry and Physics, 61 (2011) 781-807.

22. (Jointly with W. Krynski) *Canonical frames for distributions of odd rank and corank 2 with maximal first Kronecker index*, Journal of Lie theory, 21 (2011), No. 2, 307–346.

23. (Jointly with B. Doubrov) *Equivalence of variational problems of higher order*, Differential Geometry and its Applications , Volume 29, Issue 2, March 2011, Pages 255-270.

24. *On Tanaka's prolongation procedure for filtered structures of constant type*, Symmetry, Integrability and Geometry: Methods and Applications (SIGMA), special issue "Élie Cartan and Differential Geometry", v. 5, 094, 2009, 21 pages.

25. (Jointly with B. Doubrov) *On local geometry of nonholonomic rank 2 distributions*, Journal of London Mathematical Society, 2009, 80(3), 545- 566.

26. (Jointly with Chengbo Li) *Differential geometry of curves in Lagrange Grassmannians with given Young diagram*, Differential Geometry and Its Applications, 27 (2009), 723-742.

27. (Jointly with Chengbo Li) *Parametrized curves in Lagrange Grassmanians*, C.R. Acad. Sci. Paris, Ser. I, Vol. 345, Issue 11 (2007), 647-652.

28. (Jointly with A. Agrachev) *On feedback classification of control-affine systems with one and two-dimensional inputs*, SIAM Journal on Control and Optimization, Vol. 46, Issue 4 (2007), 1431-1460.

29. (Jointly with B. Doubrov) *A canonical frame for nonholonomic rank two distributions of maximal class*, C.R. Acad. Sci. Paris, Ser. I, Vol. 342, Issue 8 (15 April 2006), 589-594.

30. *Variational Approach to Differential Invariants of Rank 2 Vector Distributions*, Differential Geometry and Its Applications, Vol. 24, Issue 3 (May 2006), 235-259, (the long version in arxiv math. DG/0402171).

31. *Fundamental form and Cartan's tensor of $(2,5)$-distributions coincide*, J. Dynamical and Control Systems, Vol.12, No. 2, April 2006, 247-276.

32. (Jointly with A. Agrachev) *Nurowski's conformal structures for $(2,5)$-distributions via dynamics of abnormal extremals*, Proceedings of RIMS Symposium on "Developments of Cartan Geometry and Related Mathematical Problems", RIMS Kokyuroku series 1502 (2006), 204–218, arxiv math.DG/0605059.

33. *Complete systems of invariants for rank 1 curves in Lagrange Grassmannians*, Differential Geom. Application, Proc. Conf. Prague, 2005, pp 365-379, Charles University, Prague (see also arxiv math. DG/0411190).

34. (Jointly with A. Agrachev, N. Chtcherbakova), *On curvatures and focal points of dynamical Lagrangian distributions and their reductions by first integrals*, J. Dynamical and Control Systems, 11(2005), No.3, 297-327.

35. *On geodesic equivalence of Riemannian metrics and sub-Riemannian metrics on distributions of corank 1*, Journal of Mathematical Sciences, Vol. 135, Number 4 (June 2006), 3168 - 3194.

36. (Jointly with A. Agrachev) *Geometry of Jacobi curves. I*, J. Dynamical and Control systems, 8(2002),No. 1, 93-140.

37. (Jointly with A. Agrachev) *Geometry of Jacobi curves . II*, J. Dynamical and Control systems,8(2002), No. 2, 167-215.

38. (Jointly with A. Agrachev) *Principle Invariants of Jacobi curves*, In the book: Nonlinear Control in the Year 2000, v.1, A. Isidori, F. Lamnabhi- Lagarrigue and W.Respondek, Eds, Lecture Notes in Control and Information Sciences 258, Springer, 2001, 9-22.

39. *Nonregular abnormal extremals of 2-distribution: existence, second variation and rigidity*, J. Dynamical and Control systems , 5(1999), No. 3, 347-383.

40. (Jointly with M. Zhitomirskii) *Rigid paths of generic 2-distributions on 3-manifolds*, Duke Mathematical Journal, Vol. 79, No. 2, 1995, 281-307.

Book chapter

41. *Canonical bundles of moving frames for parametrized curves in Lagrangian Grassmannians: algebraic approach*, Appendix to the book "A comprehensive introduction to sub-Riemannian geometry. From the Hamiltonian viewpoint." by A. Agrachev D. Barilari, U. Boscain with an appendix by Igor Zelenko. Cambridge Studies in Advanced Mathematics, 181. Cambridge University Press, Cambridge, 2020. xviii+745 pp. ISBN: 978-1-108-47635-5 (see also arXiv:1812.10501)

Preprints

42. (jointly with B. Doubrov) *Vector distributions with very large symmetries via rational normal curves*, arXiv:2004.07201[math. DG] submitted, 18 pages.

43. (jointly with B. Doubrov) *On stratification of singularities of nilpotent approximations of singular distributions*, preprint 2020, available upon request, 7 pages.

44. (jointly with S. Arefizadeh and A. Talebpour) *Platooning in the Presence of a Speed Drop: A Generalized Control Model*, arXiv:1709.10083, 22 pages.

45. (jointly with B. Doubrov) *On local geometry of vector distribution with given Jacobi symbols*, 2016, submitted, arXiv:1610.09577 ,55 pages

46. (jointly with B. Doubrov) *Prolongation of quasi-principal frame bundles and geometry of flag structures on manifolds*, 2012, submitted, arXiv:1210.7334 v1 [math. DG], 47 pages.

47. (Jointly with B. Doubrov) *On local geometry of rank 3 distributions with 6-dimensional square*, preprint, 2008, arXiv:0807.3267 v1 [math.DG], 40 pages (the results of this preprint are proved in more conceptual way and generalized in the preprint [42]).

48. (Jointly with G. Berkolaiko) *Morse inequalities for ordered eigenvalues of generic self-adjoint families*, preprint arXiv:2304.04331v2[math. SP] 38 pages

Papers in preparation:

49. (Jointly with B. Doubrov) *Bifiltered parabolic geometries.*

50. (Jointly with Milan Jovanovic, Javier Martinez-Aguinaga, Alvaro del Pino) Gromov's h-principle for corank 2 distributions of odd rank through convex integration.

51. (Jointly with B. Doubrov) *Distributions controllable by abnormal extremal trajectories are of finite type.*

52. (Jointly with B. Doubrov, C. Porter, and D. Sykes) *Hypersurface realization and symmetry algebras of 2-nondegenerate flat CR structures with one-dimensional Levi kernel and nilpotent regular symbol.*

53. (jointly with Zaifeng Lin)*Affine equivalence and decoupling of Jacobi equations in sub-Riemannian Geometry.*

54. (jointly with Haoshen Li), *Triviality of classification of rank 2 distributions in 6-dimensional manifolds with vanishing Wilczynski invariants.*

55. (jointly with Haoshen Li) *Universal transformations formulas for symplectic invariants of sub-Riemannian structures on rank 2 distributions under symmetry reductions and new comparison theorems for conjugate and focal points.*

56. (jointly with N. Day) *Symplectification of Rank 2 Distributions, Cartan Prolongations, and Cartan Connections*

A monograph in preparation:

57. (Jointly with B. Doubrov) *Variational Approach to Equivalence of Geometric Structures on manifolds*;

Papers in plan:

58. (jointly with G. Berkolaiko) *A perturbative method in the Morse theory for eigenvalues of families of self-adjoint matrices.*

59. (jointly with Curtis Porter and David Sykes) *Absolute parallelism for k-nondegenerate CR structure via Tanaka like prolongations.*

60. (jointly with N. Day, B. Doubrov, and A. Medvedev) *On fundamental set of invariants for rank 2 distributions of maximal class.*

61. (jpintly with C. Sinkule) *On Levi-Civita's type theorem on projective equivalence for sub-Riemannian metrics on step 2 distributions with ad-surjective Tanaka symbols.*

62. (Jointly with E. Wendel) *All bracket generating rank 2 distributions corresponding to Monge equations are of maximal class.*

63. (Jointly with B. Doubrov and T. Morimoto) *Tanaka prolongation for filtered structures of nonconstant type.*

64. (Jointly with M. Zhitomirskii) *On Poincare-Dulac normalization and Tanaka's prolongation for filtered structures on manifolds.*

Visits:

1. Masaryk University, Brno Czech Republic (Prof. I. Kossovsky and J. Slovak)

2. The Arctic University of Norway (Prof. Boris Kruglikov and Dennis The), March 2023

3. ENSTA (École nationale supèrieure de techniques avancèes), Paris, France (Prof. Frederic Jean), 4 times: August 2015, July 2016, January 2018, October 2018;

4. Federal University of Santa Catarina, Florianopolis, Brazil (Prof. I. Kossovsky);

5. Institute of Henri Poincaré (IHP), Paris, November-December 2014

6. Trinity College, Dublin, Ireland (Prof. Dmitri Zaitsev), November 2014

7. Stanford University (Prof. Yakov Eliashberg), January 2014.

8. Australian National university, Canberra (Prof. Michael Eastwood), May 2013.

9. The Chinese University of Hong Kong, Shatin, Hong Kong (Prof W.Y.P. Lee), May 2013.

10. Mathematical Sciences Research Institute (MSRI), Berkeley (Prof. R. Bryant), March 2013

11. Institute for Advanced Study, Princeton, USA (Prof. P. Griffiths), March 2013

12. Rice University, Houston (Prof. R. Hardt), August, 2012;

13. University of Wisconsin, Madison, (Prof. G. Mari Beffa), November 17-19, 2011;

14. CIMAT, Guanajuato, Mexico (Prof. Gil Bor), March 14-March 17, 2011;

15. CSIC, Consejo Superior de Investigaciones Cientificas, Madrid, Spain, June 1–June 18, 2010, Research in Team "Gradations and nilpotentizations of control systems" in the frame of trimester "Combinatorics and Control 2010";

16. Utah State University, Logan, USA (Prof. I. Anderson and M. Fels) October-November 2009;

17. University of Tromso, Norway (Prof. B. Kruglikov), October-beginning of November 2007;

18. Institute for Advanced Study, Princeton, USA (Prof. P. Griffiths), March 2007;

19. Eduard Cech Center for Algebra and Geometry at Masaryk University of Brno, Czech Republic (Prof. J. Slovak), May 2006;

20. RIMS Kyoto and Nara Women University, Nara, Japan (Prof. T. Morimoto), October-November 2005;

21. INRIA, Nice, France (Prof. J.-B. Pomet), April 2004 and April 2005;

22. Weizmann Institute of Science, Rehovot (Prof. S. Yakovenko and V. Rom-Kedar), and Ben-Gurion University , Beer-Sheva (Prof. A. Besser), Israel, December 2003;

23. SISSA, Trieste , Italy (Prof. A. Agrachev) several times between September 1999 and February 2002 and also in July 2009, July 2011, June 2018, June 2022.

24. Steklov Institute of Mathematics (Prof A. Agrachev) , Moscow, Russia, October 1998;

25. University of California , Santa Cruz, USA, (Prof. R. Montgomery), June 1997.

Invited Lecture Series/Courses

1. I will deliver a lecture series "Cartan and Tanaka meet Pontryagin: from intrinsic geometry of distributions to extrinsic geometry of curves in flag varieties and back" on Encounter with Mathematics, Tokyo, Japan, March 8-9, 2024.

2. I delivered a Master Course "*Singularities and local geometry of vector distributions*" (24 hours, jointly with M. Zhitomirskii, Technion, Haifa) at the Institute Henri Poincaré (IHP), Paris, France, Fall 2014 in the frame of the Trimester "*Geometry, Analysis and Dynamics on Sub-Riemannian Manifolds*",

   for the video of my lectures see http://www.cmap.polytechnique.fr/subriemannian/videos/v-singularities.html

Talks in International and National Conferences:

1. Workshop on Parabolic Geometry and Related Topics, Center of Complex Geometry, Institute for Basic Studies (IBS), Daejeon, Republic of Korea, October 17– 20, 2023, Invited 1 hour talk "Triviality of classification of rank 2 distributions in 6-dimensional manifolds with vanishing Wilczynski invariants."

2. POLS Conference on "Conformal and CR geometries, and applications", Warsaw, Poland, 16 - 18 July 2023, 50 minutes invited talk "Methods of Tanaka theory in the local geometry of 2-nondegenerate CR structures of hypersurface type""

3. GRIEG meets Chopin Warsaw meeting on geometric methods in science, Warsaw, Poland, 10-14 July 2023, 50 minutes invited talk "On rank 2 distributions in 6-dimensional manifolds with vanishing Wilczynski invariants"

4. The 13th AIMS Conference on Dynamical Systems, Differential Equations and Applications, May 31– June 4, 2023, Wilmington, NC USA, Special Session on " Control and Optimization: New Developments and Applications" 30 minutes invited talk "Genericity of Projectively and Affinely Rigid Sub-Riemannian Metrics"

5. Geometry and Control in Cortona, Palazzone di Cortona, Cortona, Italy Mar 27–31, 2023, 1 hour invited talk "Morse inequalities for eigenvalue branches of generic families of self-adjoint matrices".

6. Winter School on "Cartan Geometry and reated topics" , Geilo, Norway, March 5-9, 2023, 45 minute talk "On affine equivalence of sub-Riemannian metrics on step 2 distributions with decomposable Tanaka symbols".

7. 15th Conference on Differential Geometry and its Applications (DGA), July 17-22, 2022 Hradec Královè, Czech Republic , Section on Geometric Structures and Representation Theory, 40 minutes talk "Gromov's h-principle for corank two distribution of odd rank with maximal first Kronecker index".

8. VI International Conference on "Finite Dimensional Integrable Systems in Geometry and Mathematical Physics" (FDIS), June 20-June 24, 2022, Tel-Aviv University, Israel, invited 45 minutes talk "Projective and affine equivalence of sub-Riemannian metrics: integrability, generic rigidity, the Weyl type theorems, and separation of variables conjecture."

9. The Eighth International Conference, GEOMETRY, DYNAMICS, INTEGRABLE SYSTEMS (GDIS) 2022, June 5-11, 2022, Zlatibor, Serbia, invited 30 minutes talk "Projective and affine equivalence of sub-Riemannian metrics: integrability, generic rigidity, the Weyl type theorems, and separation of variables conjecture."

10. Conference in "CR Geometry and PDEs IX", Levico Terme, Italy, May 30th - June 2nd 2022, invited 40 minutes talk "2-nondegenerate CR structures of hypersurface type: bigraded Tanaka prolongation for canonical absolute parallelism and maximally symmetric models".

11. Joint Mathematical Meeting (JMM) 2020, Denver, January 15-18, 2020, AMS Special Session on Geometry of Differential Equations, invited 25 minutes talk "2-nondegenerate CR structures of hypersurface type: bigraded Tanaka prolongation for canonical absolute parallelism and maximally symmetric models."

12. The 2nd Annual Meeting of SIAM Texas-Louisiana Section. November 1 - November 3, 2019 Southern Methodist University Dallas, TX, Minisimposium on Solvable Nonlinear Systems and Their Applications, Invited 30 minutes talk "Projective and affine equivalence in sub-Riemannian geometry: integrability and separation of variables phenomena."

13. 14th Conference on Differential Geometry and its Applications, Hradec Královè, Czech Republic, September 1–7, 2019, Section on Geometric Structures and Representation Theory, invited 40 minutes talk "Uniformly degenerated CR structures and geometry of pairs of submanifolds in Lagrangian Grassmannians".

14. AMS Spring Eastern Sectional Meeting, University of Connecticut Hartford (Hartford Regional Campus), Hartford, CT, Special Session on Sub-Riemannian and CR Geometric Analysis, Invited 25 minutes talk "Genericity of projective rigidity of sub-Riemannian metrics" .

15. Subriemannian Geometry and Beyond II, February 18-22 2019, Jyväskylä, Finland, 50 minutes invited talk "Projective and affine equivalence of sub-Riemannian metrics: toward integrability and separation of variables conjecture" .

16. Cohomology of Complex Manifolds and Special Structures, Levico Terme (Trento), Italy, June 19- 22, 2018, 50 minutes invited talk "On geometry of 2-degenerate CR structures of hypersurface type via bigraded Tanaka prolongation".

17. 38th Winter School Geometry and Physics, Czech Republic, Srni, January 13-20, 2018, 25 minute invited talk "On geometry of 2-nondegenerate CR structures of hypersurface type via bigraded Tanaka prolongation"

18. International Conference on Symmetry and Geometric Structures , November 11 - 18, 2017, Stephan Banach Center of the Institute of Mathematics of the Polish Academy of Sciences (IM PAN), Warsaw, Poland, 45 minutes invited talk "On geometry of 2-nondegenerate CR structures of hypersurface type via bigraded Tanaka prolongation".

19. 13th Conference on Differential Geometry and its Applications, Brno, Czech Republic, July 11-26, 2016, 40 minutes invited talk " Tanaka prolongation of structures of nonconstant type with application to sub-Riemannian geometry" in the session "Geometric Structures and Representation Theory"

20. 11th AIMS Conference on Dynamical Systems, Differential Equations, July 1 - 5, 2016 Orlando, 30 minutes invited talk "Injectivity properties of pole placement maps of linear control systems" in the special session "Optimal Control and Its Applications".

21. International workshop on Geometric Analysis in Control and Vision Theory, May 9-14, 2016, Bergen/Voss, Norway, 50 minutes invited talk "Geodesic equivalence of sub-Riemannian metrics: rigidity and generalized Levi-Civita theorem".

22. 36th Winter School Geometry and Physics, Czech Republic, Srni, January 16-23, 2016, 30 minute invited talk "Rigidity of sub-Riemannian structures with respect to geodesic equivalence."

23. AMS Special Session on Geometries Defined by Differential Forms at 2015 AMS/MAA Joint Mathematics Meetings San Antonio, January 10-13, 2015, 45 minutes invited talk.

    Title of the talk: *Symplectically flat vector distributions and their symmetries.*

24. International Conference "Geometric Control Theory and Analysis on Metric Structures", August 3-8, 2014, at the Lake Baikal, Russia, a satellite meeting to 2014 International Congress of Mathematics, ICM 2014, 45 minutes invited talk.

    Title of the talk: *Distributions which are controllable by abnormal trajectories are of finite type*

25. The Second Joint International Meeting of the American Mathematical Society and the Israel Mathematical Union, Tel Aviv, June 16-19, 2014, special session on Nonlinear Analysis and Optimization, 25 minutes invited talk.

    Title of the talk: *Jacobi Equations and Comparison Theorems in Optimal Control Problems*

26. Special Session on "Analysis and Topology in Special Geometries" at the AMS 2014 Spring Western Sectional Meeting at the University of New Mexico in Albuquerque, April 5-6, 2014, 25 minutes invited talk.

    Title of the talk: *Rauch and Bonnet-Myers Type Comparison Theorems in Sub-Riemannian Geometry*

27. I was one of the eight invited speakers of 2014 Spring Texas Geometry and Topology Conference, Feb. 14-16, 2014, Texas Tech University (see the webpage of the conference at http://www.math.ttu.edu/Department/Calendar/Conferences/tgtc2014/index.htm), 50 minutes talk.

    Title of the talk: *Symplectic methods in local differential geometry of nonholonomic distribution*

28. 51st Annual Allerton Conference on Communication, Control, and Computing, October 2-4, 2013, University of Illinois at Urbana-Champaign, IL, USA, 20 minutes invited talk on the session "Topology and Control".

    Title of the talk: *Rauch and Bonnet-Myers Type Comparison Theorems in Sub-Riemannian Geometry*

29. 12th Conference on Differential Geometry and its Applications, Brno, Czech Republic, August 19-24, 2013, 30 minutes invited talk in the session "Special Structures and Representation Theory".

    Title of the talk: *Wilczynski type invariants in the geometry of distributions*

30. SIAM Conference on Control and Its Applications (CT13) July 8-10, 2013, San Diego, California, 25 minutes talk on mini-symposium "Qualitative and quantitative aspects of optimal control" in the frame of this conference (Actually I am the organizer of this minisymposium).f

    Title of the talk: *Rauch and Bonnet-Myers type comparison theorems for optimal control problems*

31. INDAM meeting on Geometric Control and sub-Riemannian Geometry, Cortona, Italy, May 21 - 25, 2012, 50 minutes invited talk.

    Title of the talk: *On the Role of Fields of Abnormal extremals in Geometry of Distributions*

    (beamer slides of the talk can be found on

    http://www.cmap.polytechnique.fr/geometric-control-srg/slides2/Zelenko.pdf)

32. 2012 Spring Texas Geometry and Topology Conference, University of Houston, February 17 - 19, 2012, one hour invited talk.

    Title of the talk: Geometry of filtered structures on manifolds: Tanaka's prolongation and beyond.

    (beamer slides of the talk can be found on

    http://www.math.tamu.edu/∼ zelenko/houstonTGTC.pdf)

33. Workshop on Cartan Connections, Geometry of Homogeneous Spaces, and Dynamics, Erwin Schrödinger International Institute for Mathematical Physics (ESI), Vienna, July 11-15, 2011, one hour invited talk.

    Title of the talk: *Tanaka prolongation and symplectification procedure for filtered structures on manifolds.*

34. Workshop on Moving Frames in Geometry, CRM, Montreal, Canada, June 13-17, 2011, 40 minutes invited talk;

    Title of the talk: *Geometry of curves in parabolic homogeneous spaces.*

35. Workshop Conformal Differential Geometry and Its interaction with Representation Theory in the frame of 36th University of Arkansas Spring Lecture series, Fayetteville, Arkansas, April 7-9, 2011, 50 minutes invited talk.

    Title of the talk: *On geometry and symmetries of nonholonomoic distributions and curves of flags.*

36. Mini-workshop Vector Distributions and Sub-Riemannian Geometry, Banach Center in Warsaw, March 30- April 1, 2011, 2 invited 1 hour talks;

    Title of the first talk: *Jacobi symbols of vector distributions.*

    Title of the second talk: *Rauch type comparison theorems in sub-Riemannian geometry.*

37. International conferences on Differential Geometry and Tanaka Theory (dedicated to 60th birthday of Professors K. Yamaguchi and R. Miyaoka) , RIMS, Kyoto, Japan, January 24-28 2011, 50 minutes invited talk.

    The title of the first talk: *On geometry and symmetries of nonholonomoic distributions and curves of flags.*

38. International conferences on Differential Systems and Hypersurface Theory (dedicated to 60th birthday of Professors K. Yamaguchi and R. Miyaoka), Hiroshima University, Hiroshima, Japan, January 29-31,2011, 50 minutes invited talk.

    The title of the second talk: *On symmetries of symplectically flat rank 3 distributions.*

39. 2010 Fall Central Sectional Meeting, Notre Dame University, IN, November 5-November 7, 2010, 2 invited talks: of 45 minutes on Special on Geometry and Lie Theory and 25 minutes on Special Session on Differential Geometry and its Applications.

    The title of the first talk: *On geometry and symmetries of filtered structures on manifolds and curves of flags.*

The title of the second talk: *Comparison theorems for number of conjugate points along sub-Riemannian extremals.*

40. International Conference New Trends in Harmonic and Complex Analysis, , Jacobs University, Bremen, Germany, June 29 - July 3, 2010, 30 minutes talk in the section on Analysis on Lie groups and Mathematical Physics.

    The title of the talk: *Comparison theorems for number of conjugate points along sub-Riemannian extremals.*

41. International Conference on Combinatorics and Control, Residencia La Cristalera, the meeting center of Universidad Autonoma de Madrid, Miraflores de la Sierra, Madrid, Spain, June 21-25, 2010, 50 minute invited talk.

    Title of the talk: *On intrinsic number of functional invariants and classification of affine control systems*

42. Workshop on New trends in sub-Riemannian Geometry, Nice, France, March 29-April 2, 2010 plenary 50 min. talk

    Title of the talk: *Comparison theorems for number of conjugate points along sub-Riemannian extremals.*

43. Joint Mathematics Meeting, San Francisco, CA, January 13-16, 2010, Invited talk in AMS Special Session on Parabolic Geometries, Integrable Systems, and Twistor Theory.

    Title of the talk: *Symplectification, Generalized Tanaka Prolongations, and Geometry of Distributions.*

44. Mini-workshop on Differential systems, Utah State University, Logan, Utah, October 31-November 3, 2009, two invited talks

    Title of talks: *Symplectification, generalized Tanaka prolongation and geometry of distributions: conditions for finite type and Geometry of distributions of maximal class via geometry of curves of flags of isotropic/coisotropic subspaces in symplectic spaces.*

45. International conference Differential Equations and Topology dedicated to Centennial Anniversary of L. S. Pontryagin, Moscow State University, June 17-22, 2008.

    Title of the talk: *Contact sub-Riemannian structures as a generalization of almost Kählerian structures.*

46. 10th Conference on Differential Geometry and its Applications, Olomouc, Czech Republic, August 27-31, 2007.

    Title of the talk: *Differential geometry of curves in Lagrange Grassmannians with given Young diagram.*

47. Workshop on "Control, Optimization and Stability of non-linear systems: geometric and analytic methods", Trieste, Italy, May 30 - June 1, 2007 Title of the talk: *Parametrized curves in Lagrange Grassmannians.*

48. Midwest Geometry Conference (in honor of Thomas P. Branson) University of Iowa, Iowa City, USA, May 18 - 20, 2007.

    Title of the talk: *On Local Geometry of Nonholonomic Vector Distributions.*

49. Workshop "Geometry of vector distributions, differential equations, and variational problems", SISSA, Trieste, December 13-15 of 2006.

    Title of the talk: *Canonical frames for vector distributions of rank two and three.*

50. 2006 IMA Summer Program "Symmetries and Overdetermined Systems of Partial Differential Equations" , IMA (Institute for Mathematics and its Applications), Minneapolis, USA, July 17-August 4, 2006.

    Title of the talk: *Symplectification procedure for the equivalence problem of vector distributions.*

51. Workshop "Geometry in Nara", Nara, Japan, October 2005.

    Title of the talk: *Symplectification procedure for the equivalence problem of vector distributions.*

52. RIMS Symposium on Developments of Cartan Geometry and Related Mathematical Problems, Kyoto, Japan, October 2005.

    Title of the talk: *On canonical frames for vector distributions.*

53. 25th Winter School on Geometry and Physics, Srni, Czech Republic, January 2005.

    Title of the talk: *An intrinsic number of functional invariants and classification of affine control systems.*

54. 9th Conference on Differential Geometry and its Applications, Prague, Czech Republic, August-September 2004.

    Title of the talk: *Differential geometry of curves in Lagrange Grassmannians with application to invariants of rank 2 vector distributions.*

55. First CTS workshop, Coimbra, Portugal, July 2004.

    Title of the talk: *On feedback classification of four-dimensional affine control systems with one or two inputs.*

56. Workshop of Banach Center Research Group on "Geometry of Control Systems and Distributions", May 2004.

    Series of three talks with the title: *Differential invariants of rank 2 distributions.*

57. Trimester on "Dynamical and Control Systems" SISSA-ICTP, Italy, Sept. 8 - Dec. 7, 2003.

    Series of two talks with the title: *Dynamical Approach to Problem of Equivalence of Rank 2 Vector Distributions, I and II.*

58. Current Geometry, The International Conference on problems and trends of contemporary geometry Naples, Italy, June 2003

    Title of the talk: *A Variational Approach to Differential Invariants.*

59. Geometry in Nonlinear Control, Banach Center Workshop, Bedlevo, Poland, June 2003.

    Title of the talk: *Fundamental form and projective curvature of rank 2 distributions.*

60. The second NCN (Nonlinear Control Network) workshop, Supelec, Paris, France, June 2000.

    Title of the talk: *Geometry of Jacobi curves.*

61. International Conference in the Calculus of Variations, Technion, Haifa, March 1998.

    Title of the talk: *Nonregular abnormal geodesics of 2-distribution: existence, second variation and rigidity.*

Selected seminar talks

1. Geometry-Topology seminar, Duke University, June 1, 2023.

   Title of the talk: "Gromov's h-principle for corank two distribution of odd rank with maximal first Kronecker index".

2. Geometry and Topology Seminar, North Carolina State University, May 30, 2023

   Title of the talk: "Gromov's h-principle for corank two distribution of odd rank with maximal first Kronecker index".

3. Seminar in Real and Complex Geometry (joint session with Seminar in Geometry and Dynamics), Tel Aviv University, Tel Aviv, Israel, April 27, 2023

   Title of the talk: "Gromov's h-principle for corank two distribution of odd rank with maximal first Kronecker index".

4. Technion Geometry and Topology Seminar, Haifa, Israel, April 24, 2023.

   Title of the talk: "Gromov's h-principle for corank two distribution of odd rank with maximal first Kronecker index".

5. Differential Geometry seminar, Masaryk University at Brno, Czech Republic, April 17, 2023

   Title of the talk: "Morse inequalities for ordered eigenvalues of generic families of self-adjoint matrices."

6. Sophus Lie seminar at The Arctic University of Norway , Tromso, March 16, 2023.

   Title of the talk: "Gromov's h-principle for corank two distribution of odd rank with maximal first Kronecker index".

7. Mathematics Colloquium talk, UT Dallas, January 27, 2023.

   Title of the talk: "Projective and affine equivalence of sub-Riemannian metrics",

8. Geometry and Topology seminar, Technion-Israel Institute of Technology, Haifa, Israel, June 23, 2022.

   Title of the talk: "Morse inequalities for eigenvalue branches of generic families of self-adjoint matrices."

9. Geometric structures seminar, SISSA-International Schools for Advanced Studies, Trieste, Italy, June 16, 20222.

   Title of the talk: "Morse inequalities for eigenvalue branches of generic families of self-adjoint matrices."

10. Joint TAMU Geometry, Topology, and Mathematical Physics and Harmonic Analysis seminar, March 4, 2022.

    Title of the talk:"Morse inequalities for eigenvalue branches of generic families of self-adjoint matrices."

11. GRIEG seminar (via Zoom), Center for Theoretical Physics of Polish Academy of Sciences , Warsaw, Poland, two 90 minutes talk, June 1 and 15, 2021, the links to recordings of the talks on youtube:

    talk 1: https://www.youtube.com/watch?v=VpiuNK-7COo,

    talk 2: https://www.youtube.com/watch?v=IhGcrFsYF-s

    Title of the talks: "Geometry of rank 2 distributions via abnormal extremals: Part I and II"

12. Singularity theory seminar, Universidade Federal do Ceará, Fortaleza , Brazil, two talks: July 7 and July 28 of 2020

    Title of talk 1: " Projective and affine equivalence of sub-Riemannian metrics: integrability, generic rigidity, the Weyl type theorems, and separation of variables (the de Rham type decomposition) conjecture."

    Title of talk 2 : "Projective and affine equivalence of sub-Riemannian metrics, part 2: separation on the level of nilpotent approximation and Jacobi curves, generic projective rigidity and Weyl type theorems."

13. TAMU Geometry seminar, March 22 2019.

    Title of the talk: "Projective and affine equivalence of sub-Riemannian metrics: generic rigidity and separation of variables conjecture."

14. Geometry and Mathematical Physics seminar, SISSA-International Schools for Advanced Studies, Trieste, Italy, June 25, 2018.

    Title of the talk:" Projective and affine equivalence of sub-Riemannian metrics: toward integrability and separation of variables conjecture".

15. Department of Mathematics Colloquium, Texas Christian University, September 19, 2017

    Title of the talk " On projective and affine equivalence of sub-Riemannian metrics"

16. Department of Mathematics Colloquium, Federal University of Santa Catarina, Florianapolis, Brazil, June 22, 2016

    Title of the talk: *Geodesic Equivalence of sub-Riemannian metrics: Rigidity and Generalized Levi-Civita Theorem*

17. Symplectic Geometry Seminar, Stanford University, January 6, 2014.

    Title of the talk: *Symplectic methods in local differential geometry of nonholonomic structures.*

18. Differential Geometry seminar, Australian National University, Canberra, May 24, 2013.

    Title of the talk: *Wilczynski type invariants in the geometry of distributions.*

19. Complex analysis and Geometry seminar, Rutgers University, New Brunswick, March 8, 2013.

    Title of the talk: *Geometry of vector distributions: from Cartan to Tanaka and beyond.*

20. Mathematics Colloquium talk, UT Dallas, February 8, 2013.

    Title of the talk: *Geometry of vector distributions: from Cartan to Tanaka and beyond.*

21. Geometry-Analysis seminar, Rice University, August 22, 2012.

    Title of the talk:*Equivalence of nonholonomic vector distributions via geometry of curves of symplectic flags.*

22. Algebraic Geometry Seminar, Texas A&M University, College station, USA, April 2, 2012.

    Title of the talk: *A mod four congruence for a number of non-real solutions of Inverse Wronski Problem.*

23. Geometry and Topology Seminar, University of Wisconsin, Madison, USA, November 18, 2011.

    Title of the talk: *On geometry of curves of flags of constant type.*

24. Seminar in Differential Geometry, CIMAT, Guanajuato, Mexico, March 15, 2011.

    Title of the talk: *Tanaka prolongation and symplectification procedure for filtered structures on manifolds.*

25. Geometry and Dynamics Seminar, Tel Aviv University, Israel, June 15, 2009.

    Title of the talk: *Symplectification, Prolongations, and Geometry of Distributions.*

26. Seminar on Complex Algebraic Geometry, Institute for Advanced Studies, Princeton, USA, March 7, 2007.

    Title of the talk: *Canonical frames for nonholonomic vector distributions.*

27. The Weizmann Institute of Science, Working Seminar in Geometry and Topology, Faculty of Mathematics and Computer Science, Rehovot, Israel, June 27, 2007.

    Title of the talk: *Differential geometry of curves in Lagrange Grassmannians with given Young diagram and comparison theorems.*

28. Seminar on Differential equations and Dynamical systems, Steklov Institute of Mathematics, Moscow, Russia, October 1998.

    Title of the talk: *Nonregular abnormal geodesics of 2-distribution: existence, second variation and rigidity.*

Organization of conferences:

1. I was a co-organizer of 56th and 62th Texas Geometry and Topology conferences at Texas A&M in Fall of 2016 and 2019, respectively.

2. I was the main organizer of a 3 days workshop "Equivalence, invariants, and symmetries of vector distributions and related structures: from Cartan to Tanaka and beyond" in the frame of the Trimester "Geometry, Analysis and Dynamics on Sub-Riemannian Manifolds" at The Institute Henri Poincaré (IHP), Paris, France, Fall 2014. The webpage of the conference is http://www.math.tamu.edu/ zelenko/IHPequivalenceworkshop.html

3. I was an organizer of a mini-symposium entitled "Qualitative and quantitative aspects of optimal control" in the frame of SIAM Conference on Control and Its Applications (CT13), July 8-10, 2013, San Diego, California.

4. I was an initiator and the main organizer of the workshop"Geometry of vector distributions, differential equations, and variational problems", which took place at SISSA in December 13-15 of 2006. The main financial support was given by Central European Initiative (CEI) funds after the approval of my proposal. For the program, list of the participants, and etc see the webpage of the workshop

   http://www.math.tamu.edu/∼zelenko/CEIHomepage.html;

5. I was a coordinator of Research in Team project entitled "Gradations and nilpotentizations of control systems" in the frame of Trimester in "Control and Combinatorics", CSIC, Consejo Superior de Investigaciones Cientficas, Madrid. The team worked in June 1-June 18 2010, preprint [42] was resulted from this activity.

6. I was one of the organizers of Workshop on "Control, Optimization and Stability of non-linear systems: geometric and analytic methods", which took place at SISSA, Trieste, Italy in May 30-June 1 2007.

7. I was one of the local organizers of the Trimester on "Dynamical and Control Systems" SISSA-ICTP, Italy, Sept. 8 - Dec. 7, 2003. I was responsible for coordination of about 40 seminar talks, taking plays in this event.

Refereed for these journals:

Inventiones Inventiones mathematicae; Advances in Mathematics; Duke Mathematical Journal; Journal of Differential Geometry; Proceedings of London Mathematical Society; Geometric and Functional Analysis (GAFA); Communications on Pure and Applied Mathematics; Transformation Groups; SIAM Journal of Optimization and Control; Differential Geometry and its Applications; Nonlinearity; Journal of Differential Equations, Communication in Geometry and Analysis; ESAIM: Control, Optimization and Calculus of Variations; Mathematische Annalen; Mathematische Zeitschrift; Bulletin de la Société Mathématique de France; Journal of Dynamical and Control Systems ; Journal of Lie Theory; New York Journal of Mathematics, Journal of Mathematical Analysis and Applications; Journal of Geometry and Physics; Symmetry, Integrability and Geometry: Methods and Applications (SIGMA); Izvestija RAN. Seriya matematicheskaya.

Teaching experience:

- Differential Geometry of Curves and surfaces, MATH 439-Texas A&M University, Spring 2009, Fall 2010, Fall 2012. Fall 2018, Fall 2020, Fall 2022.

- Differential Equations, MATH308-Texas A&M University, Spring 2012, Summer 2012, Fall 2012. Fall 2013, Spring 2015, Fall 2015, Fall 2016, Spring 2017 (stack honors section), Fall 2017 (pilot sections), Fall 2021 (honors section).

- Engineering Mathematics III, MATH 251-Texas A&M University-Spring 2010, Spring 2011, Fall 2011, Fall 2019 (2 sections);

- Differential Geometry I (graduate course), MATH 622- Texas A&M University, Spring 2014, Spring 2016, Spring 2019, Spring 2022, Spring 2024.

- Differential Geometry II (graduate course), MATH 623 - Texas A&M University, Fall 2016, Fall 2018, Fall 2019, Fall 2020, Fall 2021, Fall 2022;

- Introduction to Geometric Control Theory, Graduate topics course in the frame of Seminar in Geometry, MATH666-Texas A&M University, Fall 2011, Fall 2013;

- Physics for Mathematicians, Special topic course, MATH689-Texas A&M University, Fall 2024;

- Gromov's h-principle, Graduate topics course in the frame of Seminar in Geometry, MATH666-Texas A&M University, Spring 2021;

- Introduction to Differential Geometry, a course for TAMU Math department online Master program in the frame of Seminar in Geometry, MATH666-Texas A&M University, Summer 2020.

- Topology I (graduate course), MATH 636 -Texas A&M University, Fall 2009;

- Linear Algebra for differential equations, MATH309 -Texas A&M University, Spring 2013;

- Applied Algebra, MATH433-Texas A&M University, Summer 2013;

- Engineering Mathematics II, MATH 152-Texas A&M University-Summer 2014;

- Advanced Calculus I, MATH 409-Texas A&M University, Fall 2008;

- Research (individual) course for graduate students, MATH 691-Texas A&M University, Fall 2012- till present;

- Graduate directed studies courses, Math 685-Texas A&M University (graduate directed studies) Spring 2016, Spring 2019 (Geometric Control), Fall 2016 (Riemannian Geometry), Spring 2017 (G-structures and Tanaka theory), Fall 2017 (Representation theory of Lie algebras); Spring 2018 (Optimal Control theory), Spring 2019 (Geometric Control theory, 5 participants), Fall 2019 (Introduction to sub-Riemannian Geometry, 3 participants); Spring 2022 (Introduction to Tanaka theory, 2 registered participants+1 auditor)

- Research (individual) course for undergraduate students, MATH 491-Texas A&M University, Spring 2015, Spring 2017, Fall 2017; Spring 2021 (two different projects);

- Undergraduate directed studies courses, MATH 485- -Texas A&M University, Spring 2018, Spring 2022 (Stability theory);

- Graduate course "Geometric Control Theory" at International School for Advanced Studies (SISSA-ISAS), Trieste, Italy, 27 lectures-November 2006- March 2007;

- Graduate course "Introduction to Dynamical Systems" taught twice at International School for Advanced Studies (SISSA-ISAS), Trieste, taught twice in November 2005- March 2006 and in November 2007-March 2008;

- Lecturer and teaching assistant in the course "Optimization and Control Theory" at the Master Program of ICTP-International Center for Theoretical Physics, Trieste, Italy, October 2002-January 2003;

- Teaching Assistant in Complex Analysis, various courses of Calculus (first, second and third semesters), Linear Algebra, ODEs and PDEs both for mathematicians and engineers at the Technion-Israel Institute of Technology, 1993-1994, 1996-2002

Extra (voluntary) teaching at Texas A&M University (beyond the regular courses and directed study courses)

- A series of 4 lectures on prolongation of G-structures in Spring 2019 (in addition to my Fall 2019 MATH 623 class)

- A series of 6 lectures on h-principle for Engel structures and Cartan distributions in Summer 2021 (in addition to my Spring 2021 MATH 666 , Seminar in Geometry, Gromov's h-principle class).

- A minicourse of 6 lectures on Hamiltonian approach in Differential Geometry for some students of my Fall 2021 MATH 623 class (this was in addition to the class for 2 students who were interested).

Other synergistic activity with graduate students

- I had been running the weekly group meeting on 'Local Differential Geometry and sub-Riemannian geometry" at Spring 2020 (with 6 participants), and Summer 2020 (via Zoom, with 5 participants).

- In April-May 2020 I run an international Zoom working seminar entitled "Canonical bundles of moving frames for curves in Lagrangian Grassmannian: what are the right normalization conditions" with participant from US, Italy, France, Russia, China, Ukraine.

- I had been running the informal working graduate students seminar on "Geometric Control" in Spring 2012 at Texas A& M University.

Univeristy level service

I was a member of the University level Astronaut Scholarship Foundation (AFS) selection Committee, Spring 2022. The committee selects the nominees for the prestigious $ 15,000 Astronaut Scholarship.

Departmental service

- I am a member of TAMU Executive Committee (EC) since Fall 2021.

- I am the director of the TAMU High School Math Contest since Fall 2022.

- I was a member of TAMU Math Department Graduate committee Fall 2019-August 2022.

- I was a member of TAMU Math Department Postdoc search committee since Fall 2018 and I was a chair of this committee in Fall 2019-Fall 2020;

- I was a member of TAMU Math Department Teaching Committee in Fall 2017-Fall 2019 and I was a chair of this committee in Fall 2018-Fall 2019;

- I was a member of TAMU Math Department Tenure and Promotion Committee (subcommittee T), Spring 2016-Fall 2017;

- I was a member of TAMU Math Department Award Committee, Fall 2015-2017;

Outreach activity for middle and high school students

- I have been running the lecture series on Elements of Algebraic Topology for returning students for two weeks in the frame of the Summer Mathematics Research Training High School (SMaRT) Camp at Texas A&M University in June 2019;

- I have been running the lecture series and research activities in Linear Algebra, Finite field theory, and Elements of Coding Theory for returning students during two weeks in the frame of the Summer Mathematics Research Training High School (SMaRT) Camp at Texas A&M University in June 2017;

- I ran five times the Mathematical Tournament activity for the high school students in frame of the Summer Mathematics Research Training High School (SMaRT) Camp at Texas A&M University in June 2012, June 2013, June 2016, June 2017, and June 2019.

- I was a Power Team exam writer and the leader of power grading team for annual TAMU Math High School Contest in Fall 2017, and Fall 2019. I also helped in writing Power Team exam for this contest in Fall 2020. I also was subject exam writer and grader for annual TAMU Math High School Contest in Falls of 2012, 2013, 2015, 2016, 2018, 2021, and 2022.

- I was an active lecturer in Spring 2012 at TAMU Math circle, the Mathematical enrichment activity for intermediate and middle school students (see the following links about my presentations on "Domino puzzles, invariants and walking along the grids"

  http://mathcircle.tamu.edu/index.php/article/meeting-on-march-3/ and "Invariants, coloring, and graphs"

  http://mathcircle.tamu.edu/index.php/article/next-meeting-march-24/). I also gave lectures in this Math circle for the advanced group in Spring 2015, Fall 2017, Fall 2018, and Spring 2019;

- I taught at Summer Educational Enrichment in Math (SEE-Math) for intermediate and middle school students, Texas A&M University, August 2012.

- I participate in mathematical game activities during TAMU Math Fair, Spring 2016.

Other mentoring/ service activities

- I was a mentor in the RetainU program intended to support first s year students in high risk (first generation in College, coming from a small rural high School, etc). I mentored Joseph Morrison in Fall 2017 (stopped in January 2018 due to an injury from a major car accident.)

- I was a judge in a engineering section for the Texas A&M University System Louis Stokes Alliance for Minority Participation (TAMUS LSAMP) 9th Annual Symposium, February 2013.

Community service

I was a primary faculty advisor of the TAMU Chess club Fall 2018 -Spring 2020 (the activity was harmed by the pandemics and then resumed in a different format)

Awards during my undergraduate and graduate studies:

- Wolf prize for PhD students - Hebrew University, Jerusalem, 2001;

- Gutwirth Prize for graduate students -Technion, Haifa, 1997 and 2000

- Israel Parliament (Knesset) prize for excellence in undergraduate studies, Jerusalem, 1993

- Technion President prize for excellence in undergraduate studies, Haifa, 1992.