

Gleb Pogudin

Contact Information

Affiliation **LIX, CNRS, École Polytechnique**, *Institut Polytechnique de Paris*.

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Employment

- 2020–now **Assistant Professor**, *École Polytechnique*, France.
Laboratoire d'informatique
- 2019–2020 **Assistant Professor**, *Higher School of Economics*, Moscow.
Department of Computer Science
- 2017–2019 **Assistant Professor/Faculty Fellow**, *New York University*.
Courant Institute of Mathematical Sciences
- 2017–2019 **Visiting Scholar**, *City University of New York*.
Graduate Center
- 2016–2017 **Postdoc**, *Johannes Kepler University*, Linz, Austria.
Institut für Algebra, mentored by Manuel Kauers
- 2012–2016 **Math Instructor**, *Moscow State University*.
Department of Mechanics and Mathematics and A.N.Kolmogorov high school
- 2014–2016 **Math Instructor**, *College of Moscow Institute of Physics and Technology*.
- 2012–2013 **Programmer**, *Yandex Company*.
Banner System: Real-time computations and Data Analysis

Education

- 2012–2016 **Ph.D. in Mathematics**, *Moscow State University*.
Advisor: Yu. P. Razmyslov
- 2007–2012 **Diploma in Mathematics and Applied Mathematics**, *Moscow State University*.
Advisor: Yu. P. Razmyslov. Diploma with honours.

Grants

- 2022 **Institut des sciences de l'information et de leurs interactions (INS2I)**.
"PANTOMIME: PolynomiAlizatioN and quadraTizatiOn of DynaMIcal ModElS"
- 2021-2022 **Réseau Francilien en Sciences Informatiques (RFSI)**.
"Exact ODE Reduction"
- 2021 **Institut des sciences de l'information et de leurs interactions (INS2I)**.
"MIMOSA: eliMInation in dynaMIcal mOdElS and Applications"

Publications

Preprints

1. R. Dong, C. Goodbrake, H.A. Harrington, G. Pogudin, *Differential elimination for dynamical models via projections with applications to structural identifiability*, <https://arxiv.org/abs/2111.00991>.
2. R. Ait El Manssour, G. Pogudin, *Multiplicity structure of the arc space of a fat point*, <https://arxiv.org/abs/2111.10446>.
3. A. Jiménez-Pastor, J. Jacob, G. Pogudin, *Exact linear reduction for rational dynamical systems*, <https://arxiv.org/abs/2201.13373>.
4. M. Bessonov, I. Ilmer, T. Konstantinova, A. Ovchinnikov, G. Pogudin, P. Soto, *Obtaining weights for Gröbner basis computation in parameter identifiability problems*, <https://arxiv.org/abs/2202.06297>.

Peer-reviewed articles

1. D. Pavlov, G. Pogudin, *On realizing differential-algebraic equations by rational dynamical systems*, ACM International Symposium on Symbolic and Algebraic Computation (ISSAC), doi:10.1145/3476446.3535492, 2022.
2. A. Ovchinnikov, A. Pillay, G. Pogudin, T. Scanlon, *Multi-experiment parameter identifiability of ODEs and model theory*, accepted for publication in the SIAM Journal on Applied Algebra and Geometry, 2022.
3. A. Ovchinnikov, G. Pogudin, P. Thompson, *Input-output equations and identifiability of linear ODE models*, IEEE Transactions on Automatic Control, doi:10.1109/TAC.2022.3145571, 2022.
4. D. Pavlov, G. Pogudin, Yu. Razmyslov, *From algebra to analysis: new proofs of theorems by Ritt and Seidenberg*, Proceedings of American Mathematical Society, doi:<https://doi.org/10.1090/proc/16065>, 2022.
5. A. Ovchinnikov, A. Pillay, G. Pogudin, T. Scanlon, *Computing all identifiable functions of parameters for ODE models*, System & Control Letters, doi: 0.1016/j.sysconle.2021.105030, 2021.
6. W. Li, A. Ovchinnikov, G. Pogudin, T. Scanlon, *Algorithms yield upper bounds in differential algebra*, Canadian Journal of Mathematics, doi: 10.4153/S0008414X21000560, 2021.
7. E. Amzallag, A. Minchenko, G. Pogudin, *Degree bound for toric envelope of a linear algebraic group*, Mathematics of Computation, doi: 10.1090/mcom/3695, 2021.
8. G. Pogudin, X. Zhang, *Interpretable exact linear reductions via positivity*, Computational Methods in Systems Biology (CMSB), doi: 10.1007/978-3-030-85633-5_6, 2021.
9. J. van der Hoeven, G. Pogudin, *A zero test for σ -algebraic power series*, ACM International Symposium on Symbolic and Algebraic Computation (ISSAC), doi: 10.1145/3452143.3465549, 2021.

10. A. Bychkov, G. Pogudin, *Optimal monomial quadratization for ODE systems*, International Workshop on Combinatorial Algorithms (IWOCA), doi:10.1007/978-3-030-79987-8_9, 2021.
11. I. Koswara, G. Pogudin, S. Selivanova, M. Ziegler, *Bit-complexity of solving systems of linear evolutionary partial differential equations*, Computer Science in Russia (CSR), doi:10.1007/978-3-030-79416-3_13, 2021.
12. I. C. Pérez Verona, A. Ovchinnikov, G. Pogudin, M. Tribastone, *CLUE: Exact maximal reduction of kinetic models by constrained lumping of differential equations*, Bioinformatics, doi:10.1093/bioinformatics/btab010, 2021.
13. A. Ovchinnikov, G. Pogudin, P. Thompson, *Parameter identifiability and input-output equations*, Applicable Algebra in Engineering, Communication and Computing, doi:10.1007/s00200-021-00486-8, 2021.
14. A. Ovchinnikov, G. Pogudin, N. Thieu Vo, *Bounds for elimination of unknowns in systems of differential-algebraic equations*, International Mathematics Research Notices, doi: 10.1093/imrn/rnaa302, 2020.
15. W. Li, A. Ovchinnikov, G. Pogudin, T. Scanlon, *Elimination of unknowns for systems of algebraic differential-difference equations*, Transactions of American Mathematical Society, doi:10.1090/tran/8219, 2020.
16. M. Buchacher, M. Kauers, G. Pogudin, *Separating variables in bivariate polynomial ideals*, refereed Proceedings of the 2020 ACM International Symposium on Symbolic and Algebraic Computation, pp. 54–61, 2020.
17. H. Hong, A. Ovchinnikov, G. Pogudin, C. Yap, *Global identifiability of differential models*, Communications in Pure and Applied Mathematics, vol. 73(9), pp. 1831–1879, 2020.
18. G. Pogudin, T. Scanlon, M. Wibmer, *Solving difference equations in sequences: Universality and Undecidability*, Forum of Mathematics, Sigma, vol. 8, e33, 2020.
19. A. Ovchinnikov, G. Pogudin, T. Scanlon, *Effective difference elimination and Nullstellensatz*, Journal of the European Mathematical Society, doi: 10.4171/JEMS/968, 2020.
20. E. Paul, G. Pogudin, W. Qin, R. Laubenbacher *The dynamics of canalizing Boolean networks*, Complexity, vol 2020, ID3687961, 2020.
21. G. Pogudin, *Primitive element theorem for fields with commuting derivations and automorphisms*, Selecta Mathematica, 25:57, 2019.
22. H. Hong, A. Ovchinnikov, G. Pogudin, C. Yap, *SIAN: software for structural identifiability analysis of ODE models*, Bioinformatics, vol. 35(16), pp. 2873–2874, 2019.
23. E. Amzallag, G. Pogudin, M. Sun, N. Thieu Vo, *Complexity of triangular representations of algebraic sets*, Journal of Algebra, vol. 523, pp. 342-364, 2019.
24. G. Pogudin, *A differential analog of the Noether normalization lemma*, International Mathematics Research Notices, vol. 2018(4), pp. 1177–1199, 2018.
25. G. Pogudin, A. Szanto, *Irredundant Triangular Decomposition*, refereed Proceedings of the 2018 ACM International Symposium on Symbolic and Algebraic Computation, pp. 311–318, 2018.

26. G. Pogudin, *Products of ideals and jet schemes*, Journal of Algebra, vol. 502, pp. 61–78, 2018.
27. R. Gustavson, A. Ovchinnikov, G. Pogudin, *New order bounds in differential elimination algorithms*, Journal of Symbolic Computation, vol. 85, pp. 128–147, 2018.
28. G. Pogudin, *Power series expansions for the planar monomer-dimer problem*, Physical Review E, vol. 96, 033303, 2017.
29. M. Kauers, G. Pogudin, *Bounds for Substituting Algebraic Functions into D-finite Functions*, refereed Proceedings of the 2017 ACM International Symposium on Symbolic and Algebraic Computation, pp. 245–252, 2017.
30. O. Gerasimova, Yu.P. Razmyslov, G. Pogudin *Rolling Simplexes and Their Commensurability III (Capelli Identities and Their Application to Differential Algebras)*, Journal of Mathematical Sciences, vol. 221(3), pp. 315–325, 2017.
31. G. Pogudin, Yu.P. Razmyslov, *Prime Lie algebras satisfying the standard Lie identity of degree 5*, Journal of Algebra, vol. 468, pp. 182–192, 2016.
32. R. Gustavson, A. Ovchinnikov, G. Pogudin, *Bounds for orders of derivatives in differential elimination algorithms*, refereed Proceedings of the 2016 ACM International Symposium on Symbolic and Algebraic Computation, pp. 239–246, 2016.
33. E.S. Golod, G. Pogudin, *Modules of zero Gorenstein dimension over graph algebras*, Sbornik:Mathematics, vol. 207, issue 7, pp. 81–100, 2016.
34. G. Pogudin, *The primitive element theorem for differential fields with zero derivation on the base field*, Journal of Pure and Applied Algebra, vol 219(9), pp. 4035–4041, 2015.
35. G. Pogudin, *Primary differential nil-algebras do exist*, Moscow University Mathematics Bulletin, vol 69(1), pp 33–36, 2014.
36. Yu.P. Razmyslov, G. Pogudin, *The Heisenberg envelope for the Hochschild algebra of a finite-dimensional Lie algebra*, Journal of Mathematical Sciences, vol. 193(4), pp 580–585, 2013.
37. Yu.P. Razmyslov, G. Pogudin, *Paradigm of Max-Factor and finite-dimensional representation of Lie algebras*, Moscow University Mathematics Bulletin, vol. 67(4), pp 170–172, 2012.
38. G. Pogudin, *Wronskian of derivations*, Moscow University Mathematics Bulletin, Volume 66(1), pp 47–49, 2011.

Other publications

1. M. Drmota, C. Krattenthaler, G. Pogudin, *Problem 11997*, The American Mathematical Monthly, vol. 124, number 7, p.660.

Recent presentations

1. *Exact reductions of dynamical systems*, British Applied Mathematics Colloquium, April 13, 2022, [slides](#).
2. *Quadratization of ODE systems*, Conference “Computer Algebra”, June 28, 2021, [video](#), [slides](#).

3. *Attractor structure of Boolean networks of small canalizing depth*, Society for Mathematical Biology Annual Meeting, June 14, 2021, [slides](#).
4. *Differential elimination for dynamical systems (plenary talk)*, Effective Methods in Algebraic Geometry, June 7, 2021, [video](#), [slides](#).
5. *How many experiments?*, Nonlinear Algebra Seminar, March 2, 2021, [video](#).
6. *Algorithms for exploring the structure of differential equations*, Séminaire du LIX, February 11 2021, [video](#).
7. *Elimination problem for ODE systems and parameter identifiability*, joint Pol-Sys/SpecFun seminar, December 4 2020.
8. *Structural parameter identifiability with a view towards model theory*, workshop “Model Theory of Differential Equations, Algebraic Geometry, and their Applications to Modeling” organized online by Banff International Research Station, 1-5 June 2020, [video](#).
9. *SIAN: a tool for assessing structural identifiability of parametric ODEs*, International Symposium on Symbolic and Algebraic Computation (ISSAC), Beijing, 15-18 July 2019.
10. *Parameter identifiability for ODE models via an input-output representation* (poster), SIAM Applied Algebraic Geometry, Bern, 9-13 July 2019 (Best poster award).
11. *Primitive Element Theorem for fields with derivations and automorphisms*, Applications of the model theory of fields with operators, Manchester, 17-20 June 2019.
12. *Global identifiability of differential models*, Biomathematics/Computational Biology Colloquium, Courant Institute of Mathematical Sciences, October 23 2018.
13. *Elimination of unknowns in systems of difference equations*, Differential Algebra and Related Topics IX, Leeds, 30 July - 2 August 2018.
14. *Global identifiability of differential models*, International Congress on Mathematical Software (ICMS), South Bend, 23-27 July 2018.
15. *Irredundant triangular decomposition*, International Symposium on Symbolic and Algebraic Computation (ISSAC), New York, 16-19 July 2018.
16. *Power series expansion of the free energy for monomer-dimer tilings*, Rutgers Experimental Mathematics Seminar, New Brunswick, 1 February 2018.

Teaching

- École Polytechnique:
 - Computer Programming (CSE101 and CSE102, lab sessions),
 - Concurrent and Distributed Computing (CSE305, lab sessions),
 - C++ Algorithms for Data Analysis (INF442, lab sessions),
 - Project in Computer Science (CSE303).
- Higher School of Economics:
 - Algorithms and Data Structures 1,
 - Computations in Nonlinear Algebra.
- New York University: Basic Algorithms (4 semesters).
- New York Math Circle: “College Bridge” program.

- Johannes Kepler University: Algebra for Computer Scientists, project leader for “Project Week of Applied Mathematics” ([link](#)).
- Moscow State University, Department of Mechanics and Mathematics: Abstract Algebra I, II, Ring theory.
- Moscow State University, A.N. Kolmogorov school: Calculus I, II, Intermediate Algebra.
- College of Moscow Institute of Physics and Technology: Discrete Mathematics, Probability and Statistics.

Mentoring students

Ph.D. students

2021-now Rida Ait El Manssour (Max Planck Institute for Mathematics in the Sciences), coadvised with Bernd Sturmfels

Master students

2020-2022 Andrey Bychkov (Higher School of Economics, Moscow), Master thesis “*Polynomializations and Quadraticizations of ODE systems*”

2020 Ruiwen Dong (École Polytechnique), M1 internship (joint with Heather Harrington) “*Global identifiability of differential models*”. Received “Prix du centre de recherche” from École Polytechnique.

2019-2020 Anton Zakharenkov (Higher School of Economics, Moscow), Master thesis “*Representing Tropical Rational Functions via ReLU Neural Networks*”

Bachelor students

2021 Xingjian Zhang (École Polytechnique), Bachelor thesis “*Interpretable exact linear reductions via positivity*”.

2021 Alexander Demin (Higher School of Economics, Moscow), internship “Simplifying identifiable functions for ODE models”

2020-2021 Alexander Demin and Elizaveta Demitraki (Higher School of Economics, Moscow), project “Exact ODE reductions”

2019-2020 Andrey Bychkov (Higher School of Economics, Moscow), Bachelor thesis “*Monomial quadraticization of ODEs*”.

High school students

2019-2020 Foyez Alauddin, project “*Parameters of Quadraticization of Scalar Polynomial ODE's*”. Received High Honors at the New York State Science and Engineering Fair and Best in Mathematics and Computer Science at the Delbarton Science Fair.

2018-2019 Eli Paul and William Qin, project “*The Dynamics of Canalizing Boolean Networks*”

2017-2018 Esha Sawant, project “*A method for identifying parameters in the May-Leonard system using Gröbner bases*”. Advanced to the finals of the NYC Science and Engineering Fair.

Professional service

- Program Committee Member of International Symposium on Symbolic and Numeric Algorithms for Scientific Computing, symbolic computation track (SYNASC 2021, Timisoara, Romania).
- Treasurer of the 46th International Symposium on Symbolic and Algebraic Computation (ISSAC 2021, St. Petersburg, Russia).
- Program Committee Member of Computer Algebra in Scientific Computing (CASC 2020, Linz, Austria and CASC 2021, Sochi, Russia).
- Co-organizer of the workshop Model Theory of Differential Equations, Algebraic Geometry, and their Applications to Modeling (2020, BIRS, Canada)
- Program Committee Member of the 44th International Symposium on Symbolic and Algebraic Computation (ISSAC 2019, Beijing, China).
- Chair of the Workshop on Symbolic-Numeric Methods for Differential Equations and Applications (NYU, USA, 2018).
- Selection Committee Member for Dean's Undergraduate Research Fund (NYU, USA, 2018).
- Judge of the NYU Undergraduate Research Conference (NYU, USA, 2018).
- Publicity Chair of the 43rd International Symposium on Symbolic and Algebraic Computation (ISSAC 2018, CUNY and NYU).
- Poster Committee Member of the 43rd International Symposium on Symbolic and Algebraic Computation (ISSAC 2018, CUNY and NYU).
- Local Organizer of the 8th Differential Algebra and Related Topics conference (Johannes Kepler University, Linz, Austria, 2017).

Teaching awards

- 2015, 2016 The Best Teacher of the A.N. Kolmogorov High School (Moscow State University).
2014 Grant recipient of the Education Department of Moscow.

Additional skills

Programming languages: C++, Python, Julia, Perl, Maple, Mathematica, Java, SQL, Coq.