

Lorenzo Baldi

Curriculum Vitæ

Universität Leipzig, Mathematisches Institut, Germany

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Personal Information

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Research Interests

Real Algebra, Real Algebraic Geometry and their Applications, in particular:

- Positive Polynomials
- Sums of Squares
- Real Algebraic Curves
- Polynomial Optimization

Current Position

1.6.2024– **Humboldt Postdoctoral Fellow**, *Universität Leipzig*, Algebra group
31.5.2026 Mentor: Rainer Sinn

Past Positions

1.1–31.5.'24 **Postdoctoral researcher**, *Max Planck Institute for Mathematics in the Sciences*, Nonlinear Algebra group
Mentor: Rainer Sinn
2022–2023 **Postdoctoral researcher**, *Sorbonne University*, PolSys team
Mentors: Jérémy Berthomieu and Pierre Lairez

Education and Academic Habilitations

2024–2028 **Qualification for *Maître de Conférences* positions, Section 25 (Mathematics)**, French academic habilitation for MdC (assistant professor)
2024–2028 **Qualification for *Maître de Conférences* positions, Section 26 (Applied Math.)**, French academic habilitation for MdC (assistant professor)

- 2019–2022 **Ph. D. in Mathematics**, *Inria Sophia Antipolis – Université Côte d’Azur*, ESR9 of POEMA network. Title: Effective Representations in Real Algebraic Geometry and Polynomial Optimization,
 Advisor: B. Mourrain
 Jury members: M-F. Roy (president), M. Laurent (reviewer), M. Schweighofer (reviewer), J-B. Lasserre, A. Parusiński and M. Putinar.
- 2017–2019 **Master Degree in Mathematics**, *Università di Trento*, *110/110 summa cum laude*, title: Real Tensors and Algebraic Geometry.
 Supervisor: E. Ballico.
- 2014–2017 **Bachelor Degree in Mathematics**, *Università di Firenze*, *110/110 summa cum laude*, title: Introduzione ai gruppi di movimenti rigidi.
 Supervisor: C. Casolo.

Grants and Academic Distinctions

Grants

- 2024–2026 **Humboldt Post-Doctoral Research Fellowship**, *Universität Leipzig*, awarded from the Alexander von Humboldt Foundation
 Mentor: Rainer Sinn
- 2019–2022 **Ph. D. Scholarship in POEMA**, *European Union’s H2020 research and innovation programme*, Marie Skłodowska-Curie Actions, grant n. 813211

Workshop funding

- 12.8–16.8.-24 **IWOTA 2024**, *University of Kent*, *EMS Workshop funding*
- 30.10–2.11.2023 **Research School in Real Algebraic Geometry**, *SISSA, Trieste*, *Workshops funding*
- 12–25.3.2023 **Grant Oberwolfach Leibniz Graduate Students**, *Workshops funding*

Academic distinctions

- 2017–2019 **Path of Excellence for the Master in Mathematics**, *Università di Trento*, including extra academic assignments and awarded on merit base
- 2014–2017 **Prize for the Bachelor in Mathematics and Computer Science**, *Università di Firenze*, awarded to the four best Bachelor’s students

Service

- Referee activity Journal of Algebra; SIAM Journal on Applied Algebra and Geometry; SIAM Journal on Optimization; Numerical Algebra, Control and Optimization; Optimization Letters; Mathematics of Operations Research; International Symposium on Symbolic and Algebraic Computation (ISSAC); Information and Inference: A Journal of the IMA.
 See also <https://orcid.org/0000-0001-5601-0783>
- 3.8.2024 **Co-organizer** of BM60, satellite event of MEGA 2024, Leipzig

2023– **Reviewer** for **zbMATH Open** (Zentralblatt für Mathematik)
11.2.2022 **Co-organizer** of the POEMA ESR Day, in POEMA Workshop 4, online

Research Works

In preparation

- [12] L. Baldi, R. Sinn, M. L. Telek and J. Weigert. A sparse Pólya’s theorem via toric geometry.
- [11] L. Baldi and M. L. Telek. Nonnegativity certificates and positive tropicalizations.
- [10] L. Baldi, G. Blekherman, K. Kozhasov, D. Plaumann, B. Reznick and R. Sinn. Stubborn nonnegative polynomials.

Preprints

- [9] L. Baldi, M. Kummer and D. Plaumann. Totally real divisors on curves. *Submitted for publication*.
<https://arxiv.org/abs/2509.07544>
- [8] L. Baldi, G. Blekherman and R. Sinn. Nonnegative Polynomials and Moment Problems on Algebraic Curves. *Submitted for publication*.
<https://arxiv.org/abs/2407.06017>

Journal Publications

- [7] L. Baldi, T. Krick and B. Mourrain. An Effective Positivstellensatz over the Rational Numbers for Finite Semialgebraic Sets. *Accepted for publication in Mathematics of Computation*.
<https://arxiv.org/abs/2410.04845>
- [6] L. Baldi and B. Mourrain. Exact Moment Representation in Polynomial Optimization. *Journal of Symbolic Computation* 129, 2025.
<https://doi.org/10.1016/j.jsc.2024.102403>
- [5] L. Baldi, B. Mourrain and A. Parusiński. On Łojasiewicz Inequalities and the Effective Putinar’s Positivstellensatz. *Journal of Algebra* 662, 2025, pp. 741-767.
<https://doi.org/10.1016/j.jalgebra.2024.08.022>
- [4] L. Baldi and L. Slot. Degree bounds for Putinar’s Positivstellensatz on the hypercube. *SIAM Journal on Applied Algebra and Geometry*, 2024, pp. 1–25.
<https://epubs.siam.org/doi/10.1137/23M1555430>
- [3] L. Baldi and B. Mourrain. On the effective Putinar’s Positivstellensatz and moment approximation. *Mathematical Programming* 200, 2023, pp. 71–103.
<https://doi.org/10.1007/s10107-022-01877-6>

Conference Proceedings

- [2] L. Baldi and B. Mourrain. Computing Real Radicals by Moment Optimization. *Proceedings of the 2021 on International Symposium on Symbolic and Algebraic Computation*. ISSAC '21. New York, NY, USA: Association for Computing Machinery, 2021, pp. 43–50.
<https://doi.org/10.1145/3452143.3465541>

Thesis

- [1] L. Baldi. Effective representations in real algebraic geometry and polynomial optimization. *Ph.D. Thesis*, 2022.
<https://theses.hal.science/tel-03937680>

Research Visits

- 23–27.7.2025 SISSA, Trieste
10–12.7.2024 Università di Trento, TensorDec Laboratory
18–20.6.2024 Technical University of Dresden, Real Algebraic Geometry Group
5–9.7.2023 Technical University of Dortmund, Algebra und Geometrie group
24–27.6.2023 Max Plank Institute Leipzig, Nonlinear Algebra group
19–23.6.2023 University of Magdeburg, Discrete, Convex and Toric Geometry group
8–10.6.2022 University of Konstanz, Research Group in Real Algebraic Geometry
30.5–3.6.'22 Max Plank Institute Leipzig, Nonlinear Algebra group

Teaching and Supervision Activity

Teaching

Information about my teaching activity can be found in [my website](#).

- 2025 Lecturer for the Ph.D. course *A course on Nonnegative Polynomials*, SISSA, Trieste, 10h.
<https://lorenzobaldi.github.io/teaching/>
- 2024–25 Lecturer for the Ph.D. and Master course *Real Algebraic Geometry*, University of Leipzig and MPI for Mathematics in Sciences, 28h.
<https://www.mis.mpg.de/de/events/event/real-algebraic-geometry>
<https://www.informatik.uni-leipzig.de/ifijung/10/service/stundenplaene/ws2024/dozent.html#BaldiLorenzo>
- 2023 Co-lecturer (with S. Debus) for the Ph. D. course *Semidefinite programming for Algebra, Geometry and Combinatorics*, University of Magdeburg, 30h.
https://www.mathcore.ovgu.de/index.php?show=teaching_compactcourses&course=2023alg

- 2019 *Informatica*, tutorial exercises (teaching professor: R. Zunino), Department of Mathematics, Trento
- 2018 *Geometria e algebra lineare*, tutorial exercises (teaching professors: A. Bernardi and S. Siboni), Department of Civil, Environmental and Mechanical Engineering, Trento

Supervision

- 2024–2025 Co-supervision (with R. Sinn) of the Master’s thesis *Signomial Coordinates on Convex Polytopes* by Florian Bräunlich, Leipzig University.

Programming Skills

- Languages Julia, C, Singular, Magma, Maple, Macaulay2, Git, L^AT_EX
- Packages MomentPolynomialOpt.jl, PMO.jl, MultivariateSeries.jl
developed

Talks

Invited plenary talks

- 03.2027 **Real Analytic Geometry (upcoming)**, *Title TBD*, CIRM, Marseille
- 6–10.10.2025 **Real Algebraic Geometry and Interactions (upcoming)**, *Totally real divisors on curves*, Université Côte d’Azur, Nice
- 16.12.2021 **POEMA Workshop**, *On Moment Approximation and the Effective Putinar’s Positivstellensatz*, INRIA Sophia Antipolis, Nice

Invited talks in special sessions

- 09.2026 **German Mathematical Society meeting (upcoming)**, *Title TBD*, Konstanz University
- 07.2026 **Foundations of Computational Mathematics (FoCM, upcoming)**, *Title TBD*, University of Vienna
- 7.7.2025 **SIAM Conference on Applied Algebraic Geometry**, *Totally real divisors on curves*, University of Wisconsin-Madison
- 13.8.2024 **International Workshop on Operator Theory and Applications (IWOTA)**, *Truncated moment problems for genus one curves*, invited minisymposium speaker, University of Kent
- 10.7.2023 **SIAM Conference on Applied Algebraic Geometry**, *The Cone of Non-negative Forms on Genus One Curves*, Eindhoven University of Technology
- 16.6.2023 **Foundations of Computational Mathematics (FoCM)**, *Complexity in Polynomial Optimization*, Sorbonne University, Paris
- 2.6.2023 **SIAM Conference on Optimization**, *Local Algebro-Geometric Properties for Complexity Estimates in Polynomial Optimization*, Seattle

- 25.7.2022 **International Conference on Continuous Optimization (ICCOPT)**, *On Putinar's Positivstellensatz and Convergence Rates in Polynomial Optimization*, Lehigh University, Pennsylvania
- 20.8.2021 **SIAM Conference on Applied Algebraic Geometry**, *Exact Moment Representation in Polynomial Optimization*, online
- Invited seminar talks**
- 27.2.2025 **Seminar on Nonlinear Algebra**, *The totally real divisor bound for real algebraic curves*, MPI MiS, Leipzig
- 11.7.2024 **TensorDec Lab Seminar**, *Carathéodory Numbers: a Real point of view on Nonnegative Decompositions*, Università di Trento
- 25.6.2024 **AROMATH seminar**, *Nonnegative Polynomials and Moment Problems on Algebraic Curves*, Inria Sophia Antipolis, Nice
- 18.6.2024 **Geometry seminar**, *Nonnegative Polynomials and Moment Problems on Algebraic Curves*, TU Dresden
- 8.2.2024 **Seminar on Nonlinear Algebra**, *Carathéodory numbers for measures supported on genus one curves*, MPI MiS, Leipzig
- 6.7.2023 **Oberseminar Algebra und Geometrie**, *The Effective Putinar's Positivstellensatz on the Hypercube*, TU Dortmund
- 22.6.2023 **Math Oberseminar Universität Magdeburg**, *Non-negative Polynomials on Real Plane Curves*, University of Magdeburg
- 10.6.2022 **Seminar Reelle Geometrie und Algebra**, *Convergence Rates and Flat Truncation in Lasserre's Hierarchies*, University of Konstanz
- 1.6.2022 **Seminar on Nonlinear Algebra**, *Flat Truncation in Polynomial Opt.: a Geometric and Algebraic Perspective*, MPI MiS, Leipzig
- 3.2.2022 **Joint PolSys–SpecFun Seminar**, *On Finite Convergence and Convergence Rates in Polynomial Optimization*, online

Contributed presentations

- 20.3.2025 **Winter school on Moments, Non-Negative Polynomials, and Algebraic Statistics**, *Open problems for the Effective Positivstellensätze*, Konstanz University
- 10.13.2024 **Summer School on Real Algebraic Geometry and Hodge Theory**, *Nonnegative polynomials on algebraic curves*, TU Dresden
- 30.7.2024 **Effective Methods in Algebraic Geometry (MEGA)**, *An Effective Positivstellensatz over the Rational Numbers for Finite Semialgebraic Sets*, MPI MiS, University of Leipzig
- 14.3.2024 **Moments and Polynomials: Applications and Theory (MoPAT-24)**, *Carathéodory numbers and flat extension for measures supported on genus one curves*, Zukunftskolleg, Konstanz University
- 20.3.2023 **New Directions in Real Algebraic Geometry**, *Non-negative forms on cubic curves*, contributed, Oberwolfach workshop
- 13.3.2023 **Real Algebraic Geometry with a View toward Koopman Operator Methods**, *Degree bounds for Putinar's Positivstellensatz on the hypercube*, Oberwolfach workshop
- 24.6.2022 **Effective Methods in Algebraic Geometry (MEGA)**, *On Łojasiewicz Inequalities and the Effective Positivstellensatz*, Pedagogical University of Krakow, Krakow
- 3.3.2021 **Journées nationales de calcul formel (JNCF)**, *Geometry of Lasserre's Truncated Moments*, online
- 20.7.2021 **International Symposium for Symbolic and Algebraic Computation (ISSAC)**, *Computing real radicals by moment opt.*, online
- 10.6.2021 **Effective Methods in Algebraic Geometry (MEGA)**, *Exact Moment Representation in Polynomial Optimization*, online
- 2–6.3.2020 **Journées nationales de calcul formel (JNCF)**, *Polynomial Optimization and Moments*, CIRM, Luminy, Marseille

Posters

- 24.06.2021 **Pure and Applied Algebraic Geometry (G. Ottavaini 60th birthday)**, *Some Geometric Properties of Lasserre's Truncated Moments*, online