

Alperen Ali Ergür

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Education

2016	PhD in Mathematics - <i>Texas A&M University, USA</i>
2011	MS in Mathematics- <i>Tobb University, Turkey</i>
2009	BS in Mathematics- <i>Bilkent University, Turkey</i>

Employment

Aug 2020-present	University of Texas at San Antonio <i>Assistant Professor</i> Computer Science Department (25 %) Mathematics Department (75 %)
Sep 2019-Aug 2020	Carnegie Mellon University, Theoretical Computer Science Group <i>Postdoctoral Fellow</i> Mentors: Venkatesan Guruswami and Pravesh Kothari
May 2017-Aug 2019	Technical University of Berlin, Algorithmic Algebra Group <i>Einstein Postdoctoral Fellow</i> Mentors: Peter Bürgisser and Felipe Cucker
Aug 2016-May 2017	North Carolina State University, Symbolic Computation Group <i>Postdoctoral Research Scholar</i> Mentor: Cynthia Vinzant
Sep 2011-Aug 2016	Texas A&M University, Functional Analysis and Algebraic Geometry Groups <i>Graduate Research/Teaching Assistant, and REU Instructor</i> Mentors: Grigoris Paouris and J. Maurice Rojas

Teaching Experience

1. University of Texas at San Antonio

- *Mentoring:*
Jesus Rebollo-Bueno (postdoctoral scholar, 2022 → Lecturer @ Sevilla, Spain)
Josue Tonelli-Cueto (postdoctoral scholar, 2023 → Postdoc @ John Hopkins Applied Math)
Abigail Martinez (M.S. student, 2022)
Ian Solis (undergrad researcher, 2022 → Scientist @ Southwest Research Institute)
Nina De La Torre, (undergrad researcher, 2023 → Grad School @ UT Austin)
Chris La Velle, (undergrad researcher, 2023 → Grad School @ UTSA)
- *Student-accessible research seminar on Geometry, Probability, and Computing*
Resources available at <http://alpergur.xyz/gpcseminar.html>
- *New Course Design and Redesign*
Probability and Computing
Introduction to Optimization (with C. Walton)
(Re)designing two course abstract algebra series with an algorithmic view
Algorithmic Foundations of Data Science (currently under development)
- *Instructor of the record @ UTSA Main Campus:*
Linear Algebra, Probability and Computing, Abstract Algebra,
Algebra and Number Systems (intro to proofs), Calc 2
- *Instructor of the record @ UTSA School of Data Science:*
Probability and Computing, Algorithmic Foundations of Data Science (Spring 24)

2. Technische Universität Berlin

- *Graduate Seminar:* Interior Point Methods in Convex Optimization (with T. de Wolff)
- *Graduate Class:* Effective Algebraic Geometry (with P. Bürgisser, J. Tonelli-Cueto)

3. NC State University

- Instructor of the Record: Linear Algebra for Science Majors, Calculus, Precalculus

4. Texas A&M University

- *Assistant Instructor @ Research Experience for Undergraduates Program (REU)*
Mentored *eight* undergraduate research projects in four summers: 2013-2016
7 Students → grad school @ MIT, Harvard, Chicago, Notre Dame, Brown, UIUC, TAMU
Two students won NSF graduate fellowship.
- Recitation Leader for Graduate Algebra, Probability, Advanced Calculus, Calculus

Grants, Awards, etc

2023+ MAA NExt Fellow, 2023 Class

Oct 2021 NSF-CCF-2110075, Algorithmic Foundations Program

Title: Beyond Worst-Case Analysis for Computing with Polynomials

Jan 2017 Postdoctoral Fellowship by Einstein Foundation

2014-2015 Travel Grants by University of Trento, Institut Henri Poincare, and AMS

Sept 2009 Full Scholarship by Tobb University including tuition and stipend

Sept 2004 Full Scholarship by Bilkent University including tuition and stipend

< 2004 Two Bronze, One Silver Medal in National Math Competitions

Research Interest

Real Algebraic Geometry, Convex Geometry, Randomized Numerical Algorithms, Optimization, Theory of Computation

Publications and Preprints

Google scholar: <https://scholar.google.com/citations?user=u6wvoesAAAAJ&hl=en&oi=ao>

Journal Papers

1. Multihomogenous Nonnegative Polynomials and Sums of Squares
Discrete & Computational Geometry, 2018
<https://doi.org/10.1007/s00454-018-0011-3>
2. Probabilistic Condition Number Estimates for Real Polynomials I
(with G. Paouris and J.M. Rojas)
Foundations of Computational Mathematics, 2019
<https://doi.org/10.1007/s10208-018-9380-5>
3. Approximating Nonnegative Polynomials via Spectral Sparsification
SIAM Journal on Optimization, 2019
<https://doi.org/10.1137/17M1121743>
4. Tropical Varieties for Exponential Sums
(with G. Paouris and J.M. Rojas)
Mathematische Annalen, 2020
<https://doi.org/10.1007/s00208-019-01808-5>
5. On the Expected Number of Zeros of Random Fewnomials
(with P. Bürgisser and J. Tonelli-Cueto)
SIAM Journal on Applied Algebra and Geometry (SIAGA), 2019
<https://doi.org/10.1137/18M1228682>
6. Smoothed Analysis for the Condition Number of Structured Real Polynomial Systems
(with G. Paouris and J.M. Rojas)
Mathematics of Computation, 2021
<https://doi.org/10.1090/mcom/3647>
7. On the Complexity of Plantinga-Vegter Algorithm
(with F. Cucker and J. Tonelli-Cueto)
Discrete & Computational Geometry, 2022
<https://doi.org/10.1007/s00454-022-00403-x>
8. The Rank of Sparse Random Matrices
(with A. Coja-Oghlan, Pu Gao, S. Hettereich, H. Rolvien)
Random Structures and Algorithms, 2022
<https://doi.org/10.1002/rsa.21085>
9. The Multivariate Schwartz-Zippel Lemma
(with M. L. Doğan, J. Mundo, E. Tsigaridas)
SIAM Journal of Discrete Mathematics, 2022
<https://doi.org/10.1137/20M1333869>

10. A Polyhedral Homotopy Algorithm for Real Zeros
(with T. de Wolff)
Arnold Mathematical Journal, 2022
<https://doi.org/10.1007/s40598-022-00219-w>
11. Functional Norms, Condition Numbers, and Numerical Algorithms in Algebraic Geometry
(with F. Cucker, J. Tonelli-Cueto)
Forum Mathematics Sigma, 2022
<https://doi.org/10.1017/fms.2022.89>
12. Approximate Real Symmetric Tensor Rank
(with J. Rebollo-Bueno, P. Valettas)
Arnold Mathematical Journal, 2023
<https://doi.org/10.1007/s40598-023-00235-4>
Jupyter Notebook for the code: https://alpergur.xyz/energy_increment.ipynb

Conference Papers

13. Plantinga-Vegter Algorithm Takes Average Polynomial Time
ACM Symposium on Symbolic and Algebraic Computation (ISSAC), 2019
<https://doi.org/10.1145/3326229.3326252>
14. The Rank of Sparse Random Matrices
(with A. Coja-Oghlan, Pu Gao, S. Hettereich, H. Rolvien)
ACM Symposium on Discrete Algorithms (SODA), 2020
<https://epubs.siam.org/doi/pdf/10.1137/1.9781611975994.35>
15. Beyond Worst-Case Analysis for Root Isolation Algorithms
(with J. Tonelli-Cueto, E. Tsigaridas)
ACM Symposium on Symbolic and Algebraic Computation, (ISSAC), 2022
<https://doi.acm.org?doi=3476446.3535475>

Preprints

Articles listed here are available at https://arxiv.org/a/ergur_a_1.html

16. On the Complexity of Chow and Hurwitz Forms
(with M. L. Doğan, E. Tsigaridas)
17. The Geometry of Rank Drop in a Class of Face-Splitting Matrix Products
(with S. Agarwal, E. Connelly, R. Thomas)
18. On the Number of Real Zeros of Random Sparse Polynomial Systems
(with Mate Telek, Josue Tonelli-Cueto)

Papers in Preparation

19. On the Number of Iterations of the DBA Algorithm
(with F. Brünig, A. Driemel, H. Röglin)

20. Numerical Accuracy and Stability of Algorithms for Computing the Fundamental Matrix
(with S. Agarwal, E. Connelly, R. Thomas)
21. Toric Compactifications for Analytic Combinatorics
(with T. George, S. Gillen, S. Melczer, R. Pemantle)
22. A Metric Geometry Approach to Extension Complexity
(with G. Paouris, P. Valettas)
23. Preconditioning Multivariate Polynomials via Riemannian Optimization
(with M.L. Doğan, E. Tsigaridas)

Some Talks

- Nov 2022** Algebraic Geometry and Complexity Theory Workshop, Polish Academy of Sciences
- May 2022** Real Algebraic Geometry and Optimization Seminar, Purdue University
- April 2022** Workshop on Analytical Combinatorics, AIM, San Jose, CA
- Jul 2021** Mathematical Congress of Americas, Buenos Aires, Argentina
- Jun 2021** Effective Methods in Algebraic Geometry, MEGA 2021, Tromsø Norway
- Sept 2020** Data Seminar, U Missouri Columbia
- Mar 2020** ACO Seminar, Carnegie Mellon University
- Jul 2019** SIAM Conference on Applied Algebraic Geometry 2019, Bern, Switzerland
- Jun 2019** Effective Methods in Algebraic Geometry (MEGA) 2019, Madrid, Spain
- Apr 2019** Computational Geometry Workshop, Schloss Dagstuhl, Germany
- Feb 2019** Universität Bonn, Theoretical Computer Science Seminar
- Nov 2018** Goethe Universität Frankfurt, Applied Discrete Mathematics Seminar
- Oct 2018** U Missouri Columbia, Convex Geometry Seminar
- Mar 2018** Emerging Trends in Geometric Functional Analysis, Banff (BIRS), Canada
- Dec 2017** Methods on Discrete Structures Lecture Series, TU Berlin
- Nov 2017** Algebra Meets Numerics Workshop, Berlin Academy of Sciences
- Mar 2017** U Michigan Ann Arbor, Analysis and Probability Seminar
- July 2016** Geometric Functional Analysis Concentration Week, Texas A&M
- Apr 2016** MIT, LIDS Seminar
- Apr 2016** Georgia Tech, Algebra Seminar
- Mar 2016** Univ of Chicago, Scientific Computing Seminar
- Mar 2016** NC State University, Symbolic Computation Seminar
- Dec 2015** Colorado State University, FRAGMENT Seminar
- Oct 2015** Technical University of Munich, Applied Geometry Seminar, Germany
- Sept 2015** University of Athens, Convex Geometric Analysis Seminar, Greece

Service

- 2021+** Organizer, Geometry, Probability, and Computing Seminar

- A student accessible research seminar co-organized with G. Paouris and P. Valettas
- 2023** PC Member, ACM Symposium in Algebraic Computation (ISSAC 2023)
- March 23** Panelist, NSF CCF Directory
- 2020-23** Member of the Committee to design Mathematics of Computation and Data:
New B.S. degree jointly offered by Math and CS departments of UTSA
- Nov 2021** Organizer, SIAM TX-Louisiana Section Meeting Minisymposia:
with J. M. Rojas and F. Sottile, Algorithmic Algebra and Geometry (4 sessions)
- July 2021** Organizer, Mathematical Congress of Americas Minisymposia:
with D. Armentano, M. Bender, and J. Tonelli Cueto,
Numeric-Symbolic Computation with Polynomials (3 Sessions)
- April 2020** Panelist, NSF CCF Directory
- July 2019** Organizer, SIAM Applied Algebraic Geometry Minisymposia:
with P. Lairez, G. Malajovich, and J. Tonelli Cueto,
Numerical Methods for Structured Polynomial System Solving (4 sessions)
- Fall 2017** Organizer, Algorithmic Algebra OberSeminar, with P. Bürgisser, TU Berlin
- Mar 2016** Organizer, Lecture Series on Real Stable Polynomials, Boğaziçi-METU
- Jan 2016** Organizer, Combinatorial Algebraic Geometry Workshop, Nesin Math Village
with Ö. Kışisel, H. Güntürkün, and Ö. Öztürk
- Nov 2014** Member of Power Team, Texas A&M High School Contest

References

- Teaching** Timothee Bryan (Term Assistant Professor of Mathematics, George Mason University)
- Peter Bürgisser (Professor of Algorithmic Algebra, Technical University of Berlin)
- Felipe Cucker (Professor of Mathematics, City University of Hong Kong)
- Pravesh Kothari (Assistant Professor of Computer Science, Carnegie Mellon University)
- Grigoris Paouris (Professor of Mathematics, Texas A&M University)
- J.Maurice Rojas (Professor of Mathematics and Computer Science, Texas A&M University)
- Cynthia Vinzant (Assistant Professor of Mathematics, University of Washington, Seattle)