Alperen Ali Ergür

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Education

2016 PhD in Mathematics - *Texas A&M University, USA*

2011 MS in Mathematics- *Tobb University, Turkey*

2009 BS in Mathematics- *Bilkent University, Turkey*

Employment

Aug 2020-present University of Texas at San Antonio
Assistant Professor
Computer Science Department (25 %) Mathematics Department (75 %)

Sep 2019-Aug 2020 Carnegie Mellon University, Theoretical Computer Science Group
Postdoctoral Fellow
Mentors: Venkatesan Guruswami and Pravesh Kothari

May 2017-Aug 2019 Technical University of Berlin, Algorithmic Algebra Group
Einstein Postdoctoral Fellow
Mentors: Peter Bürgisser and Felipe Cucker

Aug 2016-May 2017 North Carolina State University, Symbolic Computation Group
Postdoctoral Research Scholar
Mentor: Cynthia Vinzant

Sep 2011-Aug 2016 Texas A&M University, Functional Analysis and Algebraic Geometry Groups
Graduate Research/Teaching Assistant, and REU Instructor
Mentors: Grigoris Paouris and J. Maurice Rojas

Teaching Experience

1. University of Texas at San Antonio

    - *Mentoring:*
      Jesus Rebollo-Bueno (postdoc, 2022 → Lecturer @ Sevilla, Spain)
      Josue Tonelli-Cueto (postdoc, 2023 → Postdoc @ John Hopkins Applied Math)
      Abigail Martinez (M.S. student, 2022)
      Ian Solis (undergrad researcher, 2022 → 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 (24)

2. Technische Universität Berlin

    - *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, Precalc

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
      Two students won NSF gradaute fellowship.
    - Recitation Leader for Graduate Algebra, Probability, Advanced 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. Brüning, 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)

Selected 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, Tromso 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
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. Kişisel, 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)