Julia Lindberg

University of Texas at Austin julia.lindberg@math.utexas.edu

2515 Speedway, Austin TX, 78712 <https://sites.google.com/view/julialindberg/home>

**EMPLOYMENT**

**Bing Postdoctoral Math Instructor,** University of Texas at Austin, Mathematics Department 2023-2025

**Postdoctoral Research Assistant,** Max Planck Institute for Mathematics in the Sciences 2022

**Graduate Research Assistant,** University of Wisconsin-Madison 2018-2022

**Research Intern,** Lawrence Berkeley National Laboratory 2019

**EDUCATION**

**University of Wisconsin-Madison,** Madison, WI

 Ph.D. Electrical and Computer Engineering May 2022 Thesis: *Applications of Convex Algebraic Geometry to Power Systems, Statistics and Optimization*

 Advisors: Bernard Lesieutre (**ECE**), Jose Rodriguez (**Math**)

 *Awarded the John A. Nohel Prize for an Outstanding Thesis in Applied Math*

 M.A. Mathematics December 2020

 B.S. Mathematics, Dance May 2016

**GRANTS AND AWARDS**

NSF DMS 2318837 ($149,940 co-PI with co-PI Joe Kileel and PI Tianran Chen) 2024-2027

 *Topological Disturbance for Power Flow Equations Through the Lens of*

 *Convex and Algebraic Geometry*

 SIAM Postdoctoral Support Grant ($9,525) 2024-2025

 *Convex Optimization for Non-Convex Problems*

 SIAM Conference on Applied Algebraic Geometry Travel Award ($800) 2023

 Bing Postdoctoral Fellowship ($25,000) 2023-2025

 Junior Simons Leader for AGATES Semester Program ($2200) 2022

 Algebraic Statistics Conference Travel Award ($900) 2022

 UW Madison Graduate Student Conference Presentation Research Grant ($1200) 2021

 John A. Nohel Prize for an Outstanding Thesis in Applied Math ($250) 2021

 Excellence in Mathematical Research Award ($250) 2021

 SIAM Conference on Applied Algebraic Geometry Travel Award 2021

 Grainger Graduate Student Fellowship ($8,000) 2020

 UW Madison Graduate Student Conference Presentation Research Grant ($600) 2020

 Sarah and Dave Epstein Fellowship for Ethics in Engineering ($15,000) 2018-2020

 Lydia Z. Schafer Memorial Scholarship ($1,000) 2015

 Louis O. Kloepper Award ($1,000) 2014

**PUBLICATIONS**

1. G. Blekherman, **J. Lindberg**, K. Shu. 2025. “Symmetric hyperbolic polynomials”. *Journal of Pure and Applied Algebra.* Vol 228 Issue 2.
2. C. Améndola, **J. Lindberg**, J. I. Rodriguez. 2024. "Solving parameterized polynomial systems with decomposable projections." *To Appear in Varieties, Polyhedra and Computation Volume of EMS Series of Congress Reports.*
3. **J. Lindberg**, C. Améndola, J. I. Rodriguez. 2024. “Estimating Gaussian mixtures using sparse polynomial moment systems”. *To Appear in SIAM Journal on Mathematics of Data Science.*
4. **J. Lindberg**, J. I. Rodriguez. 2024. "Invariants of SDP exactness in quadratic programming." *Journal of Symbolic Computation* 122 (2024): 102258.
5. K. Lee, **J. Lindberg**, J. I. Rodriguez. 2024. "Implementing real polyhedral homotopy." *Journal of Software for Algebra and Geometry*. Vol 14, pp. 59-71.
6. P. Breiding, **J. Lindberg**, W. J. G. Ong, L. Sommer. 2023. "Real circles tangent to 3 conics." *Le Matematiche* 78.1, pp. 149-175.
7. Y. Abdennadher, **J. Lindberg**, B. C. Lesieutre, L. Roald. 2022. "Carbon efficient placement of data center locations." *2022 North American Power Symposium (NAPS)* pp. 1-6. IEEE.
8. **J. Lindberg**, B. Lesieutre, L. Roald. “Using geographic load shifting to reduce carbon emissions”. 2022. *Electric Power Systems Research* 212, 108586.
9. **J. Lindberg**, N. Nicholson, J. I. Rodriguez, Z. Wang. 2023. "The maximum likelihood degree of sparse polynomial systems." *SIAM Journal on Applied Algebra and Geometry* 7.1, pp. 159-171.
10. **J. Lindberg**, Y. Abdennadher, J. Chen, B. C. Lesieutre, L. Roald. 2021. "A guide to reducing carbon emissions through data center geographical load shifting." *Proceedings of the Twelfth ACM International Conference on Future Energy Systems (E2DC 2021),* pp. 430-436.
11. **J. Lindberg**, A. Zachariah, N. Boston, B. Lesieutre. 2023. "The distribution of the number of real solutions to the power flow equations." *IEEE Transactions on Power Systems* 38.2, pp. 1058-1068.
12. **J. Lindberg**, L. Roald, B. Lesieutre. 2021. “The environmental potential of hyper-scale data centers: Using locational marginal CO2 emissions to guide geographical load shifting.” *Proceedings of the 54th Hawaii International Conference on System Sciences (HICSS)*
13. **J. Lindberg**, N. Boston, B. Lesieutre. 2021. “Exploiting symmetry in the power flow equations using monodromy.” *ACM Communications in Computer Algebra,* pp. 100-104.
14. **J. Lindberg**, M. Heleno, G. Cardoso, A. Valenzuela. 2020. "A multi-period investment model for behind-the-meter PV and storage.” *2020 IEEE Power & Energy Society Innovative Smart Grid Technologies Conference (ISGT),* pp. 1-5.
15. B. Lesieutre, **J. Lindberg**, A. Zachariah, N. Boston. 2019. "On the distribution of real valued solutions to the power flow equations." *Proceedings of the 57th Annual Allerton Conference on Communication, Control, and Computing,* pp. 165-170.
16. **J. Lindberg**, A. Zachariah, N. Boston, B. Lesieutre. 2018. "The geometry of real solutions to the power flow equations." *Proceedings of the 56th Annual Allerton Conference on Communication, Control, and Computing,* pp. 596-603.

**PREPRINTS**

1. **J. Lindberg**, L. Monin, K. Rose. 2023. "The algebraic degree of sparse polynomial optimization." https://arxiv.org/abs/2308.07765
2. **J. Lindberg**, P. Santarsiero. 2023. "The symmetric geometric rank of symmetric tensors." https://arxiv.org/abs/2303.17537
3. **J. Lindberg**, L. Monin, K. Rose. 2023. "A polyhedral homotopy algorithm for computing critical points of polynomial programs." https://arxiv.org/abs/2302.04117
4. T. Chen, E. Korchevskaia, **J. Lindberg**. 2022. "On the typical and atypical solutions to the Kuramoto equations." https://arxiv.org/abs/2210.00784

[\*] J. Kileel, **J. Lindberg**. “Gaussian Voronoi Diagrams.” *In Preparation.*

[\*] H. Kottler, **J. Lindberg**, J. I. Rodriguez. “Method of Moments for Gaussian Mixtures: Implementation and Benchmarks.” *In Preparation.*

**TEACHING EXPERIENCE**

 *University of Texas at Austin* Austin, TX

 **Instructor**

* Applied Linear Algebra (Math 346) Spring 2025
* Discrete Math (Math 325K) Fall 2023, Fall 2024
* Linear Algebra (Math 340L) Spring 2024
* Calculus II (Math 408L) Spring 2023

 *University of Wisconsin-Madison* Madison, WI

 **Teaching Assistant**

* Undergraduate Research Mentor (Math 490) 2020
* Calculus II (Math 222) 2017

 **Grader**

* Matrix Methods in Machine Learning (ECE/CS/ME 532) 2021
* Abstract Algebra (Math 541) 2019, 2020
* Applied Linear Algebra (Math 443) 2019
* Cryptography (Math/ECE/CS 435) 2018
* Linear Systems (ECE 717) 2018

**ORGANIZATION**

* Co-organizer of the minisymposium *Algebraic Methods in Machine Learning and Optimization* 2025

at the annual Joint Mathematics Meeting (JMM)

* Co-organizer of the minisymposium *Algebraic Methods for Data Science* at the SIAM TX-LA2024

annual meeting

* Co-organizer of the minisymposium *Data and Certificates in Algebra and Geometry* at the 2023

SIAM Conference on Applied Algebra and Geometry

* Co-organizer of Nonlinear Algebra Seminar at Max Planck Institute 2022
* Co-organizer of ICM 2022 viewing events at Max Planck Institute 2022
* Co-organizer of the special session *Algebraic, Combinatorial and Optimization Methods for the* 2022

*Kuramoto and Power Flow Equations* at the AMS Western Sectional Meeting

* Lead organizer of UW-Madison Applied Algebra Seminar 2021-2022
* Organizer of monthly Women in ECE game night 2020-2022

**MENTORSHIP**

* Saloni Modi (Undergraduate, University of Texas at Austin) 2024
	+ Topic: Fundamentals of Convex Optimization
* Gabriel Ong (Undergraduate, Bowdoin College) 2022
	+ Topic: Real Enumerative Algebraic Geometry
* Linus Sommer (Undergraduate, University of Leipzig) 2022
	+ Topic: Real Enumerative Algebraic Geometry
* Yasmine Abdennadher (Undergraduate, University of Wisconsin-Madison) 2020-2022
	+ Topic: Load Shifting Techniques to Reduce Carbon Emissions
* Joel Steinberg (Undergraduate, University of Wisconsin-Madison) 2021
	+ Topic: Applications of Algebra to Kinematics

**SERVICE**

* Reviewer for:

- Mathematical Programming

- SIAM Journal on Applied Algebra and Geometry

- Journal of Algebraic Statistics

- IEEE Transactions on Power Systems

- ISSAC 2023

* Graduate student representative for ECE graduate committee 2021-2022
* Graduate student representative for ECE Diversity, Equity and Inclusion committee 2020-2021

**INVITED PRESENTATIONS**

 *Leveraging Algebraic Structures for Innovations in Data Science and Complex Systems* February 2025

 University of Montreal Applied Math Colloquium Montreal, CA

 *Leveraging Algebraic Structures for Innovations in Data Science and Complex Systems* January 2025

 University of Massachusetts at Boston Math Colloquium Boston, MA

 *Leveraging Algebraic Structures for Innovations in Data Science and Complex Systems* January 2025

 Johns Hopkins Applied Math Colloquium Baltimore, MD

 *Leveraging Algebraic Structures for Innovations in Data Science and Complex Systems* January 2025

 Georgia Tech Math Colloquium Atlanta, GA

 *Gaussian Voronoi Diagrams* January 2025

 JMM Special Session on Algebraic Statistics in Our Changing World Seattle, WA

 *On the Typical and Atypical Solutions to the Kuramoto Equations* January 2025

 JMM Special Session on Applications of Algebraic Geometry Seattle, WA

 *Leveraging Algebraic Structures for Innovations in Data Science and Complex Systems* December 2024

 University of Minnesota Math Colloquium Minneapolis, MN

 *Leveraging Algebraic Structures for Innovations in Data Science and Complex Systems* November 2024

 Naval Postgraduate School Operations Research Colloquium Monterey, CA

 *Circles Tangent to 3 Conics* October 2024

 SIAM Conference on Mathematics of Data Science Atlanta, GA

 *Density Estimation for Gaussian Mixture Models* October 2024

 Georgia Tech Algebra Seminar Atlanta, GA

 *Invariants of SDP Exactness in Quadratic Programming* October 2024

 SIAM TX-LA Annual Meeting Waco, TX

 *Density Estimation for Gaussian Mixture Models* October 2024

 University of Missouri Math and Data Seminar Columbia, MO

 *Gaussian Voronoi Diagrams* September 2024

 AMS Central Sectional Meeting San Antonio, TX

 *On the Typical and Atypical Solutions to the Kuramoto Equations* July 2024

 International Congress on Mathematical Software Durham, England

 *Density Estimation for Gaussian Mixture Models* July 2024

 UW Madison Applied Algebra Seminar Madison, WI

 *Circles Tangent to 3 Conics* June 2024

 Workshop on Computational and Applied Enumerative Geometry Toronto, Canada

 *Real Solutions to the Power Flow Equations* May 2024

 BIRS Workshop on Positive Solutions of Polynomial Systems Granada, Spain

 *Density Estimation for Gaussian Mixture Models* May 2024

 UCLA Applied Math Seminar Los Angeles, CA

 *On the Typical and Atypical Solutions to the Kuramoto Equations* February 2024

 Texas A&M Geometry Seminar College Station, TX

 *Estimating Gaussian Mixtures Using Sparse Polynomial Moment Systems* January 2024

 ICERM Workshop on Connecting Higher Order Statistics and Symmetric Tensors Providence, RI

 *Estimating Gaussian Mixtures Using Sparse Polynomial Moment Systems* September 2023

 UT San Antonio Matrix AI Seminar San Antonio, TX

 *The Future of Optimization and Estimation in Statistics* September 2023

 IMSI Workshop on Invitation to Algebraic Statistics and Applications Chicago, IL

 *On the Typical and Atypical Solutions to the Kuramoto Equations* July 2023

 SIAM Conference on Applied Algebraic Geometry Eindhoven, Netherlands

 *Density Estimation for Gaussian Mixture Models* June 2023

 New England Statistics Symposium Virtual

 *Invariants of SDP Exactness in Quadratic Programming* June 2023

 SIAM Conference on Optimization Seattle, WA

 *Estimating Gaussian Mixtures Using Sparse Polynomial Moment Systems* March 2023

 Online Machine Learning Seminar Virtual

 *Estimating Gaussian Mixtures Using Sparse Polynomial Moment Systems* January 2023

 Texas A&M Geometry Seminar College Station, TX

 *Estimating Gaussian Mixtures Using Sparse Polynomial Moment Systems* January 2023

 UT Austin Oden Institute Seminar Austin, TX

 *On the Typical and Atypical Solutions to the Kuramoto Equations* January 2023

 Joint Mathematics Meeting Boston, MA

 *Numerical Algebraic Geometry for the Power Flow Equations* January 2023

 JMM Short Course on Polynomial Systems, Homotopy Continuation and Applications Boston, MA

 *On the Typical and Atypical Solutions to the Kuramoto Equations* November 2022

 University of Osnabrück Algebra Seminar Osnabrück, Germany

 *The Symmetric Geometric Rank of Symmetric Tensors* November 2022

 AGATES Algebraic Geometry and Complexity Theory Workshop Warsaw, Poland

 *Estimating Gaussian Mixtures Using Sparse Polynomial Moment Systems* August 2022

 Leipzig/Magdeburg Seminar Day Leipzig, Germany

 *The Maximum Likelihood Degree of Sparse Polynomial Systems* July 2022

 International Conference on Continuous Optimization (ICCOPT) Bethlehem, PA

 *Estimating Gaussian Mixtures Using Sparse Polynomial Moment Systems* June 2022

 Max Planck Institute Nonlinear Algebra Seminar Leipzig, Germany

 *Algebraic, Combinatorial and Optimization Methods for the Kuramoto and Power Flow Equations* May 2022

 AMS Western Sectional Meeting Virtual

 *Method of Moments for Gaussian Mixture Models* April 2022

 JMM Special Session on Structured Polynomial Systems in Mathematics and Applications Virtual

 *Algebraic Methods in Power Engineering* March 2022

AMS Special Session on Computational and Applied Algebraic Geometry Virtual

 *Estimating Gaussian Mixtures Using Sparse Polynomial Moment Systems* March 2022

 AMS Special Session on Nonlinear Algebra with Applications to Statistics Virtual

 *Estimating Gaussian Mixtures Using Sparse Polynomial Moment Systems* December 2021

 CalTech Rigorous Systems Research Group Seminar Virtual

 *Estimating Gaussian Mixtures Using Sparse Polynomial Moment Systems* December 2021

 Notre Dame Applied and Computational Math and Statistics Colloquium Virtual

 *Estimating Gaussian Mixtures Using Sparse Polynomial Moment Systems* November 2021

 Princeton IDeAS Seminar Virtual

 *Polynomial System Solving in Applications* October 2021

 LAAS Toulouse BrainPOP Seminar Virtual

 *Method of Moments for Gaussian Mixture Models* October 2021

 UC San Diego Optimization and Data Science Seminar Virtual

 *Polynomial System Solving in Applications* September 2021

 UW Madison SIAM Graduate Student Seminar Madison, WI

 *Method of Moments for Gaussian Mixture Models* September 2021

 Boise State Topics in Algebra, Topology, Etc. Research Seminar Virtual

 *Method of Moments for Gaussian Mixture Models* August 2021

 SIAM AG Conference on Applied Algebraic Geometry Virtual

 *A Guide to Reducing Carbon Emissions through Data Center Geographical Load Shifting* June 2021

 ACM e-Energy 9th International Workshop on Energy-Efficient Data Centers Virtual

 *Method of Moments for Gaussian Mixture Models* June 2021

 MPI Leipzig Workshop on Software and Applications of Numerical Nonlinear Algebra Virtual

 *Method of Moments for Gaussian Mixture Models* May 2021

 San Francisco State Algebra, Geometry, and Combinatorics Seminar Virtual

 *The Environmental Potential of Hyper-Scale Data Centers* January 2021

 Hawaii International Conference on System Sciences Virtual

 *Exploiting Symmetry in the Power Flow Equations Using Monodromy* July 2020

 International Symposium on Symbolic and Algebraic Computation Virtual

 *A Multi-Period Investment Model for Behind-the-Meter PV and Storage* February 2020

The Eleventh Conference on Innovative Smart Grid Technologies (ISGT) Washington DC

 *Algebraic Methods in Power Engineering* November 2019

Georgia Tech Energy Systems and Optimization Workshop Atlanta, GA

 *Algebraic Methods in Power Engineering* October 2019

NSF Algorithms for Threat Detection and Modern Power Systems Workshop Washington DC

 *Algebraic Methods in Power Engineering* September 2019

AMS Fall Central Sectional Meeting Madison, WI

 *The Distribution of Numbers of Operating Points of Power Networks* July 2019

International Congress on Industrial and Applied Mathematics Valencia, Spain

 *The Distribution of Numbers of Operating Points of Power Networks* July 2019

SIAM Conference on Applied Algebraic Geometry Bern, Switzerland

 *The Geometry of Real Solutions to the Power Flow Equations* October 2018

Allerton Conference on Communication, Control and Computing Peoria, IL

 *The Geometry of Real Solutions to the Power Flow Equations* October 2018

University of Wisconsin-Madison Applied Algebra Seminar Madison, WI