Kisun Lee

University of California San Diego, Department of Mathematics, Stefen E. Warschawski Visiting Assistant Professor.

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pronouns: he, him, his

Research Interest

Applied algebraic geometry and nonlinear algebra. Specifically, algorithms and applications of numerical algebraic geometry, algebraic combinatorics and convex geometry.

Employment

University of California San Diego, La Jolla, California *Jul 2020 - Present*

Stefen E. Warschawski Visiting Assistant Professor.

Mentor : Jiawang Nie

Semester Program Nonlinear Algebra at ICERM *Sep 2018 - Dec 2018*

Short Term Visiting.

Education

Georgia Institute of Technology, Atlanta, Georgia *Aug 2015 - May 2020*

Ph.D, Mathematics

Advisor : Anton Leykin

Thesis : Finding and certifying numerical roots of systems of equations

Sogang University, Seoul, Korea *Mar 2009 - Feb 2015*

B.S, Mathematics

Preprints/Publications

M. Burr, K. Lee & A. Leykin. Isolating clusters of zeros of analytic systems using arbitrary-degree inflation. *preprint.*

K. Lee, S. Melczer & J. Smolčić. Homotopy techniques for analytic combinatorics in several variables. *In Proceedings of International Symposium on Symbolic and Numeric Algorithms for Scientific Computing 2022.* (2022).

K. Lee & X. Tang. On the polyhedral homotopy method for solving generalized Nash equilibrium problems of polynomials. *Journal of Scientific Computing*. **95** (2023) no. 13.

K. Lee. The NumericalCertification package in Macaulay2. *preprint*.

K. Lee, J. Lindberg & J. I. Rodriguez. Implementing real polyhedral homotopy. *preprint*.

D. I. Bernstein, G. Blekherman & K. Lee. Typical ranks in symmetric matrix completion. *Journal of Pure and Applied Algebra*. **225** (2021) no. 7, 106603.

K. Lee. Certifying approximate solutions to polynomial systems on `Macaulay2`. *ACM Communications in Computer Algebra*. **53** (2019) no. 2, pp 45–48.

K. Lee, N. Li & L. Zhi. On isolation of singular zeros of multivariate analytic systems. *preprint* (currently, there is an error in Section 4).

M. Burr, K. Lee & A. Leykin. Effective certification of approximate solutions to systems of equations involving analytic functions. *In Proceedings of the 2019 on International Symposium on Symbolic and Algebraic Computation*. (2019) pp 267–274.

T. Duff, C. Hill, A. N. Jensen, K. Lee, A. Leykin & J. Sommars. Solving polynomial systems via homotopy continuation and monodromy. *IMA Journal of Numerical Analysis*. **39** (2019) no. 3, pp 1421–1446.

W. Jung, J. L. Kim, Y. Kim & K. Lee. The dimension of magic squares over fields of characteristics two and three. *Linear Algebra and its Applications*. **472** (2015) pp 118-134.

Software

`ACSVHomtopy.jl` (joint with S. Melczer & J. Smolčić), a Julia package.

`RealPolyhedralHomotopy.jl` (joint with J. Lindberg & J. I. Rodriguez), a Julia package.

`NumericalCertification.m2`, a Macaulay2 package.

`EigenSolver.m2` (joint with L. Busé, J. Chen, A. Leykin, T. Pajdla & E. Pirnes), a Macaulay2 package.

`MonodromySolver.m2` (joint with T. Duff, C. Hill, A. N. Jensen, A. Leykin & J. Sommars), a Macaulay2 package.

Awards/Honors

AMS MRC Travel Grant. ($ 950)	*Winter 2023*
CCAAGs-22 Travel Grant. ($636)	*Summer 2022*
Macaulay2 Conference at CSU Travel Grant. ($879)	*Spring 2022*
Grant for AMS Mathematical Research Community Program. ($1175)	*Summer 2021*
Georgia Tech Outstanding TA. ($300)	*Spring 2020*
ISSAC 2019 Travel Grant.	*Summer 2019*
SIAM AG 19 Travel Grant.	*Summer 2019*
MEGA 2019 Travel Grant.	*Summer 2019*
Georgia Tech Outstanding Student Teaching Evaluation.	*Spring 2018*

Sogang University Dean's List. *Fall 2012, Fall 2013*

Korea Student Aid Foundation (KOSAF)
The Scholarship for Natural Sciences and Engineering Students. *2012 - 2013*

Conference Talks and Posters

Presentation : "Homotopy techniques for analytic combinatorics in several variables", January 2023, Joint Mathematics Meeting 2023, Boston, Massachusetts, US.

Presentation : "Homotopy techniques for analytic combinatorics in several variables", September 2022, International Symposium on Symbolic and Numeric Algorithms for Scientific Computing 2022, Linz, Austria. (Virtual)

Presentation : "Certifying roots of polynomial systems on Macaulay2", May 2022, Macaualy2 Conference at CSU, Cleveland, Ohio, US.

Presentation : "Polyhedral Homotopy Method for Nash Equilibrium Problem", April 2022, AMA Colloquium Series on Young Scholars in Optimization and Data Science, Hong Kong. (Virtual)

Presentation : "Computing asymtotics for multivariate rational functions using numerical algebraic geometry", April 2022, Joint Mathematics Meeting 2022, Seattle, Washington, US. (Virtual)

Presentation : "Polyhedral Homotopy Method for Nash Equilibrium Problem", April 2022, Joint Mathematics Meeting 2022, Seattle, Washington, US. (Virtual)

Presentation : "Polyhedral Homotopy Method for Nash Equilibrium Problem", November 2021, UCSD Optimization and Data Science Seminar, La Jolla, California, US. (Virtual)

Presentation : "Polyhedral Homotopy Method for Nash Equilibrium Problem", July 2021, SIAM Conference on Applied Algebraic Geometry, College Station, Texas, US. (Virtual)

Presentation : "Finding and certifying numerical roots of systems of equations", February 2021, University of California San Diego Algebraic Geometry Seminar, La Jolla, California, US. (Virtual)

Presentation : "Typical ranks in real symmetric matrix completion.", March 2020, AMS Sectional Meeting, Charlottesville, Virginia, US. (Cancelled)

Presentation : "Certifying Solutions to a Square Analytic System", October 2019, Joint CUNY Graduate Center-Courant Seminar in Symbolic-Numeric Computing, New York, US.

Presentation : "Certifying Solutions to a Square Analytic System", October 2019, Clemson University Algebra and Discrete Mathematics Seminar, Clemson, US.

Presentation : "Certifying Solutions to a Square Analytic System", October 2019, Georgia Institute of Technology Algebra Seminar, Atlanta, US.

Presentation : "Certifying Approximate Solutions to Polynomial Systems on Macaulay2", July 2019, 44th International Symposium on Symbolic and Algebraic Computation, Beijing, China.

Presentation : "Certifying Solutions to a Square System Involving Analytic Functions", July 2019, 44th International Symposium on Symbolic and Algebraic Computation, Beijing, China.

Presentation : "Certifying Solutions to a Square System Involving Analytic Functions", July 2019, SIAM Conference on Applied Algebraic Geometry, Bern, Switzerland.

Poster : "Typical Ranks of Semisimple Graphs", July 2019, Summer School on Randomness and Learning in Non-Linear Algebra, Leipzig, Germany.

Poster : "Typical Ranks of Semisimple Graphs", June 2019, Effective Methods in Algebraic Geometry, Madrid, Spain.

Poster : "Certification for Roots of Systems Involving Analytic Functions", April 2019, Meetings on Applied Algebraic Geometry, Atlanta, US.

Poster : "Monodromy Solvers", November 2018, Nonlinear Algebra in Applications, Providence, US.

Poster : "Monodromy Solvers", September 2018, Core Computational Methods, Providence, US.

Poster : "Monodromy Solvers", April 2018, Meeting on Applied Algebraic Geometry, Atlanta, US.

Poster : "Solving Polynomial System Using Package MonodromySolver", August 2017, SIAM Conference on Applied Algebraic Geometry, Atlanta, US.

Presentation : "Solving Polynomial Systems via Homotopy Continuation and Monodromy" (joint with Timothy Duff), October 2016, AMS Sectional Meeting , Denver, US.

Teaching Experience *&* Mentoring

Mentoring Experience

- Aniket Iyer (Undergraduate, UC San Diego) *Fall 2022 - present*
- Liangyu Hu (Undergraduate, UC San Diego) *Fall 2022 - present*
  - Received TRELS Conference Funding.
- Group Leader : Directed Reading - Real Polyhedral Homotopy *Summer 2021*
- Program Mentor : AWM Mentorship program *Spring 2021*

Department of Mathematics, University of California San Diego

- Math 20D, Introduction to Differential Equations, Winter 2021, Fall 2021, Winter 2022, Fall 2022, Winter 2023 (Lead Instructor).
- Math 20C, Calculus *&* Analytic Geometry For Science *&* Engineering, Fall 2021, Spring 2022 (Lead Instructor).
- Math 10C, Calculus III, Winter 2021, Spring 2021 (Lead Instructor).
- Math 103A, Modern Algebra I, Fall 2020 (Lead Instructor).

School of Mathematics, Georgia Institute of Technology

- Math 1711, Finite Mathematics, Spring 2019, Fall 2019, Spring 2020 (Lead Instructor).
- Math 1552, Integral Calculus, Summer 2019 (Lead Instructor).
- Math 1555, Calculus for Life Science, Spring 2018 (Lead Instructor).
- Math 1551, Differential Calculus, Fall 2017, Summer 2018 (Lead Instructor).
- Math 2552, Differential Equation, Spring 2016, Fall 2016, Spring 2017, Summer 2017 (Teaching Assistant).
- Math 1553, Introduction of Linear Algebra, Fall 2015 (Lecture Assistant).

Department of Mathematics, Sogang University

- Undergraduate Student Tutor.

Skills

Programming : MATLAB, Macaulay2, Julia, Python (SageMath).

Foreign Languages : Native Korean, Fluent English.

Activities & Services

UC San Diego AWM Mentorship Program Coordinator.	*Fall 2022 - present*
UC San Diego AWM Mentorship Program (Mentor).	*2021*
Group Leader for NumericalCertification Project at Macaulay2 Workshop at CSU.	*2020*
Georgia Tech School of Mathematics Graduate Student Council.	*2019 - 2020*
Georgia Tech LGBTQIA+ Allyship Program.	*2019*
Organizer of the Student Algebraic Geometry Seminar at Georgia Tech.	*2018*
AMS Graduate Student Chapter (Treasury).	*2017 - 2018*
SIAM Conference on Applied Algebraic Geometry 2017 (Volunteer).	*August 2017*
Seoul International Congress of Mathematicians 2014 (Volunteer).	*August 2014*