Department of Mathematics
Oden Institute for Computational Engineering and Sciences
University of Texas at Austin

jkileel@math.utexas.edu | web.ma.utexas.edu/users/jkileel/
Offices: PMA 12.154 and POB 3.434 | Austin, TX 78712-1199, USA

## Research interests

**Applied mathematics and computational algebra**: tensor decomposition, data analysis and compression, nonconvex optimization landscapes, applied algebraic geometry, and the method of moments; applications to cryo-electron microscopy, computer vision, scientific machine learning, digital twins, and AI for mathematics.

## Academic appointments

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| 2026–present | **Associate Professor** (with tenure), Department of Mathematics and Oden Institute, University of Texas at Austin. |
| 2020–2026 | **Assistant Professor**, Department of Mathematics and Oden Institute, University of Texas at Austin. |
| 2017–2020 | **Postdoctoral Fellow**, Program in Applied and Computational Mathematics, Princeton University.<br>Advisor: Amit Singer. Supported by the Simons Collaboration on Algorithms and Geometry. |

## Education

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| 2012–2017 | **Ph.D. in Mathematics**, University of California, Berkeley.<br>Dissertation: Algebraic Geometry for Computer Vision. Advisor: Bernd Sturmfels. |
| 2008–2012 | **M.Math. and B.A. in Mathematics**, University of Cambridge. |

## Honors and awards

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| 2026–2027 | Moncrief Grand Challenge Faculty Award, University of Texas at Austin. |
| 2025–2029 | Peter O'Donnell Distinguished Researcher Award, University of Texas at Austin. |
| 2025–2027 | **Alfred P. Sloan Research Fellowship in Mathematics.** |
| 2023 | ACHA Charles Chui Young Researcher Best Paper Award, for "Estimation under group actions: Recovering orbits from invariants." |
| 2017–2020 | Simons Collaboration on Algorithms and Geometry Postdoctoral Fellowship. |
| 2017 | Bernard Friedman Memorial Prize for Best Thesis in Applied Mathematics, University of California, Berkeley. |
| Summer 2016 | Chateaubriand Fellowship, Embassy of France in the United States. |
| 2008–2011 | Blyth Cambridge Commonwealth Scholarship (two scholarships in Canada). |

## Research funding

### Awarded grants

**Alfred P. Sloan Foundation**
*Sloan Research Fellowship in Mathematics*
Principal investigator | September 15, 2025–September 14, 2027 (expected).
Award budget: $75,000; under my supervision: $75,000.

**National Science Foundation · DMS 2436499**
*FDT-BioTech: A Digital Twin Framework for Developing and Analyzing Virtual Patient Cohorts to Enable Virtual Clinical Trials*
Co-principal investigator | December 15, 2024–November 30, 2027 (expected).
Award budget: $952,867; under my supervision: $74,848. PI: David Hormuth. Other co-PIs: Karen Willcox, Thomas Yankeelov, and Anirban Chaudhuri (all at UT Austin).

**Department of Energy · DE SC0025312**
*Adaptive, Efficient, and Safe: General Tools for Streaming Large-Scale Tensors*
Principal investigator | September 1, 2024–August 31, 2027 (expected).
Award budget: $495,000; under my supervision: $446,829. Co-PI: Gunnar Martinsson (UT Austin).

**National Science Foundation · IIS 2312746**
*Collaborative Research: RI: Medium: Bridging the Semantic-Metric Gap via Multinocular Image Integration*
Principal investigator | September 1, 2023–August 31, 2027 (expected).
Award budget: $90,671; under my supervision: $90,671. PIs on corresponding collaborative grants: Benjamin Kimia (Brown University) and Ahmad Abdelfattah (University of Tennessee).

**National Science Foundation · DMS 2309782**
*NSF-BSF: Computational Methods for Shape Space Analysis in Structural Biology*
Principal investigator | June 15, 2023–May 31, 2027 (after a no-cost extension).
Award budget: $275,000; under my supervision: $275,000. PI on corresponding BSF grant in Israel: Amit Moscovich (Tel Aviv University).

### Pending proposals and nominations

**National Science Foundation CAREER**
Principal investigator; application pending, 2026.

**Schmidt Sciences Polymaths**
Selected as one of two University of Texas at Austin institutional nominees; application pending, 2026.

PUBLICATIONS Google Scholar | arXiv papers

**Peer-reviewed and accepted publications**

1. Mohammed Abouzaid, Andrew Blumberg, Martin Hairer, **Joe Kileel**, Tamara Kolda, Paul Nelson, Daniel Spielman, Nikhil Srivastava, Rachel Ward, Shmuel Weinberger, Lauren Williams. *First proof.* Bulletin of the American Mathematical Society, accepted, pp. 1–73.
2. Bobby Shi, Julia Lindberg, **Joe Kileel**. *Efficient tensor decomposition via moment matrix extension.* Journal of Symbolic Computation, 139, 102612 (2027), pp. 1–56.
3. **Joe Kileel**, Oscar Mickelin, Amit Singer, Sheng Xu. *Two datasets are better than one: Method of double moments for 3-D reconstruction in cryo-EM.* Inverse Problems, 42, 075016 (2026), pp. 1–36.
4. Daniel Miao, Gilad Lerman, **Joe Kileel**. *QuadSync: Quadrifocal tensor synchronization via Tucker decomposition.* IEEE Conference on Computer Vision and Pattern Recognition (2026), 30 pages including supplement [oral presentation].
5. Adriana Duncan, **Joe Kileel**. *Higher-order group synchronization.* Research in the Mathematical Sciences 13, 48 (2026), pp. 1–40.
6. Michael Fraiman, Paulina Hoyos, Tamir Bendory, **Joe Kileel**, Oscar Mickelin, Nir Sharon, Amit Singer. *SO(3)-invariant PCA with application to molecular data.* IEEE International Symposium on Biomedical Imaging (2026), 5 pages [oral presentation].
7. Yossi Arjevani, Joan Bruna, **Joe Kileel**, Elzbieta Polak, Matthew Trager. *Geometry and optimization of shallow polynomial networks.* SIAM Journal on Applied Algebra and Geometry 10(2) (2026), pp. 174–209.
8. Hongyi Fan, **Joe Kileel**, Benjamin Kimia. *Condition numbers in multiview geometry, instability in relative pose estimation, and RANSAC.* IEEE Transactions on Pattern Analysis and Machine Intelligence 48 (2026), pp. 2855–2869.
9. Yifan Zhang, **Joe Kileel**. *Covering number of real algebraic varieties and beyond: Improved bounds and applications.* Foundations of Computational Mathematics (2025), pp. 1–48.
10. **Joe Kileel**, Kathlen Kohn. *Snapshot of algebraic vision.* Combinatorial, Computational, and Applied Algebraic Geometry: A Tribute to Bernd Sturmfels, AMS Proceedings of Symposia in Pure Mathematics 111 (2025), pp. 323–363 [refereed book chapter].
11. **Joe Kileel**, João Pereira. *Subspace power method for symmetric tensor decomposition.* Numerical Algorithms (2025), pp. 1–38.
12. **Joe Kileel**, Nicholas Marshall, Oscar Mickelin, Amit Singer. *Fast expansion into harmonics on the ball.* SIAM Journal on Scientific Computing 47(2) (2025), pp. A1117–A1144.
13. Eitan Levin, **Joe Kileel**, Nicolas Boumal. *The effect of smooth parametrizations on nonconvex optimization landscapes.* Mathematical Programming 209(1) (2025), pp. 63–111.
14. Daniel Miao, Gilad Lerman, **Joe Kileel**. *Tensor-based synchronization and the low-rankness of the block trifocal tensor.* Advances in Neural Information Processing Systems (2024), pp. 1–28.
15. Ruhui Jin, **Joe Kileel**, Tamara Kolda, Rachel Ward. *Scalable symmetric Tucker tensor decomposition.* SIAM Journal on Matrix Analysis and Applications 45(4) (2024), pp. 1746–1781.
16. Tommi Muller, Adriana Duncan, Eric Verbeke, **Joe Kileel**. *Algebraic constraints and algorithms for common lines in cryo-EM.* Biological Imaging 4, E9 (2024), pp. 1–30.

17. Eitan Rosen, Paulina Hoyos, Xiuyuan Cheng, **Joe Kileel**, Yoel Shkolnisky. *The G-invariant graph Laplacian Part I: Convergence rate and eigendecomposition.* Applied and Computational Harmonic Analysis 71 (2024), pp. 1–35.
18. Andy Zhang, Oscar Mickelin, **Joe Kileel**, Eric Verbeke, Nicholas Marshall, Marc Aurele Gilles, Amit Singer. *Moment-based metrics for molecules computable from cryo-EM images.* Biological Imaging 4, E3 (2024), pp. 1–22.
19. Yifan Zhang, **Joe Kileel**. *Moment estimation for nonparametric mixture models through implicit tensor decomposition.* SIAM Journal on Mathematics of Data Science 5(4) (2023), pp. 1130–1159.
20. Yulia Alexandr, **Joe Kileel**, Bernd Sturmfels. *Moment varieties for mixtures of products.* ACM International Symposium on Symbolic and Algebraic Computation (2023), pp. 53–60.
21. Tamir Bendory, Yuehaw Khoo, **Joe Kileel**, Oscar Mickelin, Amit Singer. *Autocorrelation analysis for cryo-EM with sparsity constraints: Improved sample complexity and projection-based algorithms.* Proceedings of the National Academy of Sciences 120(18) (2023), e2216507120; 18 pages including supplement.
22. Afonso Bandeira, Ben Blum-Smith, **Joe Kileel**, Jonathan Niles-Weed, Amelia Perry, Alexander Wein. *Estimation under group actions: Recovering orbits from invariants.* Applied and Computational Harmonic Analysis 66 (2023), pp. 236–319.
23. Eitan Levin, **Joe Kileel**, Nicolas Boumal. *Finding stationary points on bounded-rank matrices: A geometric hurdle and a smooth remedy.* Mathematical Programming 199(1) (2023), pp. 831–864.
24. Hongyi Fan, **Joe Kileel**, Benjamin Kimia. *On the instability of relative pose estimation and RANSAC's role.* IEEE Conference on Computer Vision and Pattern Recognition (2022), pp. 8935–8943.
25. **Joe Kileel**, Timo Klock, João Pereira. *Landscape analysis of an improved power method for tensor decomposition.* Advances in Neural Information Processing Systems (2021), pp. 6253–6265.
26. **Joe Kileel**, Amit Moscovich, Nathan Zelesko, Amit Singer. *Manifold learning with arbitrary norms.* Journal of Fourier Analysis and Applications 27, 82 (2021), pp. 1–56.
27. Nathan Zelesko, Amit Moscovich, **Joe Kileel**, Amit Singer. *Earthmover-based manifold learning for analyzing molecular conformation spaces.* IEEE International Symposium on Biomedical Imaging (2020), pp. 1715–1719.
28. Nir Sharon, **Joe Kileel**, Yuehaw Khoo, Boris Landa, Amit Singer. *Method of moments for 3-D single particle ab initio modeling with non-uniform distribution of viewing angles.* Inverse Problems 36(4) (2020), pp. 1–40.
29. **Joe Kileel**, Matthew Trager, Joan Bruna. *On the expressive power of deep polynomial neural networks.* Advances in Neural Information Processing Systems (2019), pp. 10310–10319.
30. Justin Chen, **Joe Kileel**. *Numerical implicitization.* Journal of Software for Algebra and Geometry 9(1) (2019), pp. 55–63.
31. Eitan Levin, Tamir Bendory, Nicolas Boumal, **Joe Kileel**, Amit Singer. *3D ab initio modeling in cryo-EM by autocorrelation analysis.* IEEE International Symposium on Biomedical Imaging (2018), pp. 1569–1573 [oral presentation].
32. **Joe Kileel**, Zuzana Kukelova, Tomas Pajdla, Bernd Sturmfels. *Distortion varieties.* Foundations of Computational Mathematics 18 (2018), pp. 1043–1071.
33. Gunnar Fløystad, **Joe Kileel**, Giorgio Ottaviani. *The Chow form of the essential variety in computer vision.* Journal of Symbolic Computation 86 (2018), pp. 97–119.
34. **Joe Kileel**. *Minimal problems for the calibrated trifocal variety.* SIAM Journal on Applied Algebra and Geometry 1 (2017), pp. 575–598.

35. Zuzana Kukelova, **Joe Kileel**, Bernd Sturmfels, Tomas Pajdla. *A clever elimination strategy for efficient minimal solvers.* IEEE Conference on Computer Vision and Pattern Recognition (2017), pp. 3605–3614.
36. Michael Joswig, **Joe Kileel**, Bernd Sturmfels, André Wagner. *Rigid multiview varieties.* International Journal of Algebra and Computation 26 (2016), pp. 775–788.
37. Cristiano Bocci, Enrico Carlini, **Joe Kileel**. *Hadamard products of linear spaces.* Journal of Algebra 448 (2016), pp. 595–617.

**Preprints**

38. Paulina Hoyos, **Joe Kileel**. *Singular value decompositions over *-algebras with applications to tensor decompositions.* arXiv:2610.40450, pp. 1–36.
39. Yeari Vigder, Paulina Hoyos, David Thong, Joakim Andén, **Joe Kileel**, Amit Moscovich. *Group invariant spectral embedding.* arXiv:2607.08987, pp. 1–28.
40. March Boedihardjo, **Joe Kileel**, Vandy Tombs. *Testing the mixture model hypothesis via spectral gap.* arXiv:2603.03245, pp. 1–29.
41. Kexin Wang, Salil Bhate, João Pereira, **Joe Kileel**, Matylda Figlerowicz, Anna Seigal. *Multi-context principal component analysis.* arXiv:2601.15239, pp. 1–47.
42. Kexin Wang, João Pereira, **Joe Kileel**, Anna Seigal. *Multi-subspace power method for decomposing partially symmetric tensors.* arXiv:2510.18627, pp. 1–36.
43. Yifan Zhang, **Joe Kileel**. *Norming sets for tensor and polynomial sketching.* arXiv:2506.05174, pp. 1–16.
44. Gabriel Brown, **Joe Kileel**, Tamara Kolda. *The fascinating world of* $2 \times 2 \times 2$ *tensors: Its geometry and optimization challenges.* arXiv:2504.03937, pp. 1–33.
45. João Pereira, **Joe Kileel**, Tamara Kolda. *Tensor moments of Gaussian mixture models: Theory and applications.* arXiv:2202.06930, pp. 1–42.

Citation metrics as of November 2026: >1350 citations; h-index 20. Publication list: 37 peer-reviewed or accepted works; 8 preprints.

## Patents and patent applications

1. *Method of moments for 3-D reconstruction in cryo-electron microscopy from multiple datasets with different viewing angle distributions.* Amit Singer, **Joe Kileel**, Oscar Mickelin, Sheng Xu. United States application 64/189,664; filed November 2, 2026.
2. *Trifocal block tensor-based synchronization and applications to computer vision systems.* Gilad Lerman, **Joe Kileel**, Daniel Miao. United States application 19/328,427; filed September 15, 2025.
3. *Fully automatic, template-free particle picking for electron microscopy.* Amit Singer, Ayelet Heimowitz, Joakim Anden, Yuehaw Khoo, **Joe Kileel**. United States patent 11,557,034 B2, January 17, 2023; China patent ZL201880046702.X, April 28, 2023.

## Research supervision

**Postdoctoral researchers**

**Paul Beckman** | September 2025–present
Peter O'Donnell Jr. Postdoctoral Fellow, Oden Institute. Ph.D.: New York University. Co-mentored with Gunnar Martinsson.

**Julia Lindberg** | January 2023–July 2025
Bing Instructor, Department of Mathematics. Ph.D.: University of Wisconsin–Madison. First placement: tenure-track Assistant Professor of Mathematics, Georgia Institute of Technology.

**João Pereira** | January 2021–May 2022
Postdoctoral Fellow, Oden Institute. Ph.D.: Princeton University. Co-mentored with Rachel Ward. First placement: tenure-track Assistant Professor, IMPA, Brazil.

### Completed doctorates

Three sole-advised doctorates and one co-advised doctorate.

**Adriana Duncan** · Mathematics; sole advisor; completed Ph.D. in five years.
Research: Higher-order group synchronization, with applications to computer vision and cryo-EM. Frank Gerth III Outstanding Dissertation Award. First placement: Data Scientist, Samsung Austin Semiconductor.

**Yifan Zhang** · Oden Institute; sole advisor; completed Ph.D. in six years.
Research: Tensor decomposition, method of moments, and randomized dimension reduction of real algebraic varieties. UT Continuing Fellowship awardee, 2024–2025. First placement: Quantitative Researcher, Citadel Securities.

**Elzbieta Polak** · Mathematics; sole advisor; completed Ph.D. in six years.
Research: Discriminants in polynomial optimization, with applications to image processing and neural-network training. First placement: Data Scientist, Travelers.

**George Torres** · Mathematics; co-advisor with Ngoc Tran (main advisor); completed Ph.D. in six years.
Research: Tropical geometry for ReLU neural networks and optimization of polytopes. First placement: Research Scientist, Striveworks.

### Current doctoral students

The four students listed below are solely advised.

**Paulina Hoyos** · Mathematics, Ph.D. candidate; sixth year.
Research: Manifold learning under group actions, tensor-structured linear systems, t-product, and cryo-ET. UT Continuing Fellowship awardee, 2024–2025.

**Gabriel Brown** · Oden Institute, Ph.D. candidate; fifth year.
Research: Tensor decomposition, ill-posedness, and data compression for scientific simulations. DOE Office of Science Graduate Student Research awardee, Fall 2026.

**Mina Parast** · Mathematics, Ph.D. student; fourth year.
Research: Multimarginal optimal transport, low-rank methods, and representation learning.

**Michael Liu** · Oden Institute, Ph.D. student; third year.
Research: Equivariant machine learning, and applications of invariant theory to constitutive modeling.

### Visiting doctoral students

**Alexandru Crăciun** | Fall 2026
Visiting Ph.D. student from Technical University of Munich, Theoretical Foundations of AI group.
Research: Optimization landscapes and dynamics for polynomial neural networks.

### Undergraduate research and thesis supervision

- **Lohit Jagarapu**. Second reader, senior thesis in Mathematics. Research: generative modeling over functional maps. First placement: Ph.D. student in Computer Science, Courant Institute, New York University.
- **John Breedis**. Second reader, scientific computing certificate, Oden Institute. Research: approximation theory and neural networks. First placement: M.Eng. student in Computational Science and Engineering, Harvard University.
- **Bryan Doan**. Advisor, scientific computation and data sciences certificate, Department of Statistics and Data Science. Research: 3-D steerable principal component analysis. First placement: industry.
- **Bronson Zhou**. Advisor, summer research in Mathematics. Research: fast transforms and computing with molecules. Babuška scholarship. First placement: Ph.D. student in Statistics and Data Science, Yale University.

- **Eitan Levin**. Co-advisor, undergraduate thesis, Princeton University. Research: numerical optimization on varieties. Princeton thesis prize. First placement: Ph.D. student in Applied and Computational Mathematics, California Institute of Technology.
- **Changshuo Liu**. Co-advisor, undergraduate thesis, Princeton University. Research: method of moments and cryo-EM. Princeton thesis prize. First placement: Quantitative Financial Researcher, GTS.

## PROFESSIONAL SERVICE

### Research programs, workshops, and schools

| | |
|---|---|
| Spring 2027 | Co-organizer, **approved semester-long program** "Metric Algebraic Geometry," Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University. |
| April 2027 | Co-organizer, approved weeklong workshop "Extended Systems and Boundary Conditions," part of the "Numerical Algebraic Geometry and Correlated Electrons" program, Institute for Pure and Applied Mathematics (IPAM), UCLA. |
| February 2027 | Co-organizer, approved workshop "Algebraic Distance Optimization," part of "Metric Algebraic Geometry," ICERM, Brown University. |
| November 2026 | Co-organizer, approved minisymposium "Tensor Methods in Data Science," SIAM Conference on Mathematics of Data Science. |
| July 2026 | Co-organizer, weeklong workshop "Mathematics of 3D Reconstruction," ICERM, Brown University. |
| March 2026 | **Lead organizer**, SQuaRE "Randomized Numerical Linear Algebra for Tensor Applications," American Institute of Mathematics, California Institute of Technology; first session. |
| March 2025 | Co-organizer, minisymposium "Tensors in Scientific Computing and Engineering," SIAM Conference on Computational Science and Engineering, Fort Worth. |
| February 2025 | Co-organizer, two-day workshop "Mathematics of Deep Learning," Institute for Foundations of Machine Learning, UT Austin. |
| October 2024 | Co-organizer, minisymposium "Processing Data with Geometric Structure," SIAM Conference on Mathematics of Data Science, Atlanta. |
| October 2024 | Co-organizer, minisymposium "Algebraic Methods for Data Science," SIAM TX–LA Section annual meeting, Baylor University. |
| January 2024 | Co-organizer, weeklong school "Winter Program in ML," Department of Mathematics, UT Austin. |
| January 2024 | Co-organizer, weeklong workshop "Connecting Higher-Order Statistics and Symmetric Tensors," ICERM, Brown University. |
| June 2023 | Co-organizer, minisymposium "Parameterizations and Nonconvex Landscapes," SIAM Conference on Optimization, University of Washington. |
| March 2021 | Co-organizer, minisymposium "Data-Driven Scientific Computing," SIAM Conference on Computational Science and Engineering, Fort Worth (virtual). |
| June 2020 | Co-organizer, minisymposium "Theoretical and Computational Aspects of the Method of Moments," SIAM Conference on Mathematics of Data Science, Cincinnati (virtual). |

### Grant and prize service

- **NSF panel service:** Computational Mathematics (2024, 2025); Mathematical Biology (2025).
- **Ad hoc proposal reviews:** German Research Foundation (2026); NSF Computational Mathematics (2024, 2025); United States–Israel BSF (2025); National Science Centre, Poland (2025); Czech Science Foundation (2025).

- **Invited nominator,** Shaw Prize in Mathematical Sciences (2026, 2027).

**Journal, conference, and book reviewing**

**Journals:** SIAM Journal on Mathematics of Data Science; SIAM Journal on Applied Algebra and Geometry; SIAM Journal on Matrix Analysis and Applications; SIAM Journal on Imaging Sciences; Mathematical Programming; Advances in Mathematics; Advances in Computational Mathematics; Experimental Mathematics; Journal of Machine Learning Research; Nature Communications; Linear Algebra and its Applications; Foundations of Computational Mathematics; Applied and Computational Harmonic Analysis; Journal of Fourier Analysis and Applications; Algebraic Statistics; Acta Crystallographica Section D; Journal of Mathematical Imaging and Vision; Annals of Statistics; Journal of Algebra; International Journal of Computer Vision; Courant Journal of Pure and Applied Mathematics.

**Quick opinions:** Communications on Pure and Applied Mathematics; Memoirs of the AMS; Journal of the AMS.

**Conferences:** NeurIPS, ICML, ICLR, CVPR, STOC, COLT, MEGA, FOCS, ECCV, ACCV, BMVC, MLSB.

**Books:** Springer's Applied and Numerical Harmonic Analysis series.

**Professional memberships**

American Mathematical Society; Society for Industrial and Applied Mathematics.

## Teaching

University of Texas at Austin

**Foundational Techniques of Machine Learning and Data Sciences**. Graduate. Preliminary examination course. Spring 2026, Spring 2024, Fall 2023.

**Tensor Methods**. Graduate. Topics course. Fall 2025.

**Geometric Methods in Data Science**. Graduate. Topics course. Fall 2021.

**Scientific Computation in Numerical Analysis**. Undergraduate. Upper-division course. Fall 2026, Fall 2023, Spring 2022.

**Real Analysis I**. Undergraduate. Upper-division course. Spring 2021.

**Differential and Integral Calculus**. Undergraduate. Lower-division course. Spring 2025, Fall 2024.

## University and departmental service

**Academic leadership and faculty recruitment**

- Co-organizer, Math and AI Working Lunches, Mathematics (2026–2027).
- **Co-chair,** Ph.D. Admissions Committee, Oden Institute (2025–2026).
- Member, Scientific Machine Learning Faculty Search Committee: Mathematics, Computer Science, and Oden Institute (2025–2026); Mathematics and Oden Institute (2024–2025).
- Co-organizer, Computational and Applied Mathematics Seminar, Department of Mathematics (since Fall 2025); Oden Institute Seminar (since Spring 2025).
- Member, Bing Instructor (postdoctoral) Search Committee, Department of Mathematics (2024–2025, 2025–2026).
- Member, Ph.D. Admissions Committee: Mathematics (2021–2022, 2024–2025); Oden Institute (2021–2022, 2023–2024, 2024–2025).
- Member, CSEM Graduate Studies Subcommittee, Oden Institute (2024–2027).
- Member, Professional-Track Faculty Chair's Committee, Mathematics (2023–2025); Professional-Track Faculty Annual Review Committee, Mathematics (2023–2024).

**Curriculum, assessment, and outreach**

- Member, Math Around Us Course Design Committee, Mathematics (2026–2027).
- **Chair,** Foundations for AI Curriculum Design Committee, Oden Institute (2026–2027).
- Member, Statistics/Probability Courses Reform Committee, Mathematics (2026–2027).
- Member, Calculus/AI Education Committee, College of Natural Sciences and Cockrell School of Engineering (2025–2026).
- Project member, CALCx: UT Math/STEMx Initiative to redesign first-year calculus sequences (2024–2025).
- Member, Mathematics Website Development Committee (2024–2025).
- Member, Oden Institute Ph.D. Dissertation Award Committee (Spring 2023) and Dissertation Writing Fellowship Committee (Spring 2024).
- Member, Oden Institute Preliminary Examination Committee: Data Science examination (Spring 2023, Spring 2024); retest (Summer 2021, Summer 2024).
- Leader of reading courses in computational algebraic geometry, Gröbner bases, group synchronization, manifold learning, data compression, low-rank tensor and matrix optimization, and 3-D reconstruction.
- Quantitative Reasoning flag proposer for M 348, Scientific Computation in Numerical Analysis (2023).
- Marshal, College of Natural Sciences undergraduate commencement (2023); undergraduate outreach presentation, UT Dean's Scholars (2023).

**Dissertation and proposal committees (non-advisor)**

**UT Austin:** Youguang Chen (Biros); Jeffrey Cochran (Hughes and Bui-Thanh; forthcoming); Yijung Dong (Martinsson and Ward); Patrícia Muñoz Ewald (Chen); Zhou Fang (Israel and Xu); Rodrigo González Hernandez (Gamba); Lewis Liu (Tsai); Andrew Moore (Chen); Minh Nguyen (Bajaj); Tiffany Phan (Jah); Will Ruys (Biros); Bobby Shi (Ward); Zachary Stoebner (Tamir; forthcoming); Casey Stowers (Yankeelov); Xin Tang (Baldea); Lukas Taus (Tsai); Zheyu Wen (Biros); Yuege Xie (Ward); Yi Wang (Bajaj); Jinpai Zhao (Dawson). Advisors are in parentheses.

**External:** Alessandro Tamai, Ph.D. thesis committee, Scuola Internazionale Superiore di Studi Avanzati, Italy; Daniel Miao, Ph.D. thesis and proposal committee, University of Minnesota, Twin Cities.

Invited talks and lectures

**Forthcoming invitations**

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| July 2027 | International Conference on Sampling Theory and Applications, Special Session on Invariant Theory for Signal Processing and Machine Learning, Utrecht, Netherlands. |
| April 2027 | Workshop on Extended Systems and Boundary Conditions in Numerical Algebraic Geometry and Correlated Electrons Program, IPAM, UCLA. |
| February 2027 | Workshop on Algebraic Geometry: A Window into Machine Learning, IPAM, UCLA. |
| January 2027 | Joint Mathematics Meeting, Special Session on Mathematics of Data Science and Machine Learning, Chicago. |
| January 2027 | Joint Mathematics Meeting, Special Session on Algebraic, Topological and Geometric Methods in Machine Learning, Chicago. |
| January 2027 | Joint Mathematics Meeting, Special Session on Algebra and Geometry in Computations, Chicago. |
| December 2026 | Workshop on Matrix Optimization, Institute for Mathematical Sciences, National University of Singapore. |
| December 2026 | Seminar on AI/Mathematics/Statistics, Harvard University. |
| November 2026 | SIAM Mathematics of Data Science Conference, Minisymposium on Algebraic Approaches to Generalization in Machine Learning, Salt Lake City. |
| November 2026 | Applied Mathematics Seminar, Texas Tech University. Virtual. |
| October 2026 | Annual Meeting of SIAM TX-LA Section, Minisymposium on Applications of Algebraic Geometry, Southern Methodist University. |
| October 2026 | Annual Meeting of SIAM TX-LA Section, Minisymposium on Tensor Computations, Data Science and Applications, Southern Methodist University. |
| October 2026 | Wallenberg Advanced Scientific Forum on Symmetries in Neural Networks, Stockholm, Sweden. |

**2026**

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| September | Conference of Italian Network for Applied and Birational Algebraic Geometry, Siena, Italy. Virtual. |
| July | Workshop on Rigidity Theory and Geometric Data Science, ICERM, Brown University. |
| June | Workshop on Metric Algebraic Geometry, Institut Mittag-Leffler, Sweden. |
| June | Kolloquium, Osnabrück University, Germany. |
| May | Conference of International Linear Algebra Society, Virginia Tech. |
| April | Texas Algebraic Geometry Symposium, Texas A&M. |
| Spring | Young Mathematician Lecture Series, National University of Singapore. |
| January | Joint Mathematics Meeting, Special Session on Algebraic Methods in Machine Learning and Optimization, Washington, D.C. |

**2025**

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| November | Applied Mathematics Seminar, University of California, Berkeley / Lawrence Berkeley Laboratory. |
| November | Workshop on Randomness, Invariants and Complexity, Simons Institute, University of California, Berkeley. |
| September | Annual Meeting of SIAM TX-LA Section, Minisymposium on Geometric Data Analysis, UT Austin. |

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| September | Annual Meeting of SIAM TX-LA Section, Minisymposium on Scientific Machine Learning, UT Austin. |
| July | International Conference on Continuous Optimization, Minisymposium on Optimization on Stratified Sets, University of Southern California. |
| July | SIAM Conference on Applied Algebraic Geometry, Minisymposium on Algebraic Approaches to Machine Learning, University of Wisconsin-Madison. |
| July | SIAM Conference on Applied Algebraic Geometry, Minisymposium on Algebraic Approaches to Computational Optimization, University of Wisconsin-Madison. Substitute speaker. |
| June | Conference of International Linear Algebra Society 2025, Minisymposium on Numerical Multilinear Algebra, Kaohsiung, Taiwan. |
| April | Colloquium, Department of Mathematics, University of Texas at San Antonio. |
| March | Sophex Seminar, Department of Mathematics, UT Austin. |
| March | DOE Advanced Scientific Computing Research CS PI Meeting, Lightning Talk, Frisco, TX. |
| March | Babuška Forum, Oden Institute for Computational Engineering and Sciences, UT Austin. |
| March | SIAM Conference on Computational Science and Engineering, Minisymposium on Tensors, Fort Worth. Co-organizer and speaker. |
| February | Mathematics of Machine Learning Seminar, Max Planck Institute for Mathematics in the Sciences and UCLA. Virtual. |
| January | One World Mathematics of INformation, Data, and Signals (1W-MINDS) Seminar. Virtual. |
| January | Joint Mathematics Meeting, Special Session on Algebraic Statistics, Seattle. |
| January | Joint Mathematics Meeting, Special Session on Nonlinear Algebra for Machine Learning, Seattle. |
| January | Joint Mathematics Meeting, Special Session on Geometric Methods in Deep Learning, Seattle. |

**2024**

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| December | IMS International Conference on Statistics and Data Science, Session on Tensor Methods, Nice, France. |
| November | Colloquium, Department of Mathematics, Michigan State University. |
| October | SIAM Conference on Mathematics of Data Science, Minisymposium on Algebraic Geometry and Machine Learning, Atlanta. |
| September | BIRS-CMO Workshop on Computational Harmonic Analysis in Data Science and Machine Learning, Casa Matemática Oaxaca, Mexico. |
| September | AMS Central Sectional Meeting, Special Session on Applications of Algebraic Geometry, University of Texas at San Antonio. |
| July | International Symposium on Mathematical Programming, Special Session on Moment, Polynomial and Tensor Optimization, Montreal, Canada. |
| July | NSF CompMath PI meeting, Special Session on Data Science, University of Washington. Contributed. |
| March | Joint Mathematics of Data & Decisions (MADDD) and Algebraic Geometry Seminar, University of California, Davis. |
| March | Codes and Expansions (CodEx) Seminar. Virtual. |
| January | Winter Program in ML, Minicourse on Tensor Methods in Data Science, Department of Mathematics, UT Austin. Co-organizer and instructor. |
| January | Topical Workshop on Higher-Order Statistics and Symmetric Tensors, ICERM, Brown University. Co-organizer and speaker. |

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| January | Joint Mathematics Meeting, Special Session on Mathematics of Computer Vision, San Francisco. Virtual. |

**2023**

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| December | Bayesian Statistics and Statistical Learning Workshop, Institute for Mathematical and Statistical Innovation, University of Chicago. |
| November | PSU-Purdue-UMD Joint Seminar on Mathematical Data Science. Virtual. |
| November | Annual Meeting of SIAM TX-LA Section, University of Louisiana at Lafayette. |
| October | FFT Conference, Norbert Wiener Center for Harmonic Analysis and Applications, Charles Chui Prize Lecture, University of Maryland, College Park. |
| September | Workshop on Invitation to Algebraic Statistics and Applications, Tutorial Lecture, Institute for Mathematical and Statistical Innovation, University of Chicago. |
| September | Workshop on Mathematical Methods for Exploring and Analyzing Morphological Shapes Across Biological Scales, Banff International Research Station, Canada. Virtual. |
| August | International Council for Industrial and Applied Mathematics, Minisymposium on Randomized Numerical Linear Algebra, Tokyo, Japan. |
| July | SIAM Conference on Applied Algebraic Geometry, Minisymposium on Applications of Tensors, Eindhoven, Netherlands. |
| June | SIAM Conference on Optimization, Minisymposium on Nonconvex Landscapes, Seattle. Co-organizer and speaker. |
| May | Oden Institute Seminar, Oden Institute for Computational Engineering and Sciences, UT Austin. |
| February | SIAM Conference on Computational Science and Engineering, Minisymposium on 3D Reconstruction, Amsterdam, Netherlands. |
| February | Topics in Algebra, Topology, Etc., Research Seminar (TATERS), Boise State University. Virtual. |
| January | Alan Turing-Oden Institutes Workshop, Short Talk, London, United Kingdom. |
| January | Colloquium, Department of Mathematics, University of Missouri. |
| January | Joint Mathematics Meeting, Special Session on Data Science, Boston. |
| January | Joint Mathematics Meeting, Special Session on Numerical Homotopy Continuation, Boston. |
| January | Joint Mathematics Meeting, Special Session on Tensors, Boston. |

**2022**

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| December | Colloquium, Department of Mathematics, UT Austin. |
| November | Colloquium, Program in Applied and Computational Mathematics, Princeton University. |
| November | Cryo-Electron Microscopy and Beyond Workshop, IPAM, UCLA. |
| November | Data and Learning Seminar, IMPA, Rio de Janeiro, Brazil. |
| October | Mathematical Machine Learning Seminar, Max Planck Institute for Mathematics in the Sciences and UCLA. Virtual. |
| September | SIAM Conference on Mathematics of Data Science, Minisymposium on Optimal Transport, San Diego. Virtual. |
| September | ML+X Seminar, Institute for Foundations of Machine Learning, UT Austin. |
| June | Combinatorial, Computational, and Applied Algebraic Geometry Conference, University of Washington. |

May — Workshop on Mathematical and Computational Challenges in Cryogenic Electron Microscopy, University of British Columbia, Vancouver, Canada.

March — AMS Special Session on Data Science, Tufts University. Virtual.

February — IMA Data Science Seminar, University of Minnesota.

**2021**

November — Applied Mathematics Seminar, Yale University. Virtual.

November — SIAM Texas-Louisiana Sectional Meeting, Minisymposium on Algorithmic Algebra and Geometry, University of Texas at Rio Grande Valley. Virtual.

October — BIRS-CMO Workshop on Geometry & Learning from Data, Casa Matemática Oaxaca, Mexico. Virtual.

October — Computational and Applied Mathematics Colloquium, University of Chicago.

August — SIAM Conference on Applied Algebraic Geometry, Minisymposium on Algebraic Geometry and Machine Learning, Texas A&M University. Virtual.

June — Data Science Seminar, University of Oxford. Virtual.

May — Tensors Seminar Series, IPAM, UCLA. Virtual.

March — Applied and Computational Mathematics Seminar, National University of Singapore. Virtual.

January — Algebraic Geometry Seminar, University of California, Davis. Virtual.

January — Tsinghua Sanya International Mathematics Forum, Workshop on Algebraic Geometry and Machine Learning. Virtual.

**2020**

November — Geometry Seminar, Texas A&M University. Virtual.

November — Babuška Forum, Oden Institute for Computational Engineering and Sciences, UT Austin. Virtual.

October — SIAM Texas-Louisiana Section, Minisymposium on Applications of Algebraic Geometry, Texas A&M University. Virtual.

October — SIAM Texas-Louisiana Section, Minisymposium on Algebraic, Geometric, and Combinatorial Methods in Mathematical Biology, Texas A&M University. Virtual.

September — Algebraic Statistics Online Seminar. Virtual.

June — SIAM Conference on Mathematics of Data Science, Special Session on Algebraic Geometry and Machine Learning, Cincinnati. Virtual.

March — Colloquium, School of Mathematics, Georgia Institute of Technology.

February — Colloquium, Division of Applied Mathematics, Brown University.

February — Colloquium, Courant Institute of Mathematical Sciences, New York University.

February — Colloquium, Department of Mathematics, University of Wisconsin-Madison.

January — Colloquium, Department of Mathematics, Duke University.

January — Colloquium, Department of Mathematics, Rutgers University-New Brunswick.

January — Analysis Seminar, Department of Mathematics, UT Austin.

January — Colloquium, Oden Institute for Computational Engineering and Sciences, UT Austin.

January — Colloquium, Department of Mathematics, University of Toronto, Canada.

**2019**

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| December | Joint Applied Mathematics / Statistics & Data Science Seminar, Yale University. |
| November | Novel Medical Imaging Workshop, Texas A&M University. |
| November | Linear Algebra Seminar, Auburn University. |
| October | Algebra Seminar, University of Washington. |
| October | SIAM Pacific Northwest Section, Special Session on Algebra, Geometry and Applications, Seattle University. |
| September | AMS Sectional Meeting, University of Wisconsin-Madison, Special Session on Applications of Algebra and Geometry. |
| August | Big Data Conference, Center of Mathematical Sciences and Applications, Harvard University. |
| August | NYC Computational Cryo-EM Summer Workshop, Center for Computational Mathematics, Flatiron Institute. |
| July | SIAM Conference on Applied Algebraic Geometry, Universität Bern, Switzerland, Minisymposium on Algebraic Vision. |
| May | Computational and Applied Mathematics Colloquium, University of Chicago. |
| May | Applied Algebra Seminar, University of Wisconsin. |
| April | Algebra Seminar, Georgia Institute of Technology. |
| March | AMS Sectional Meeting, Auburn University, Special Session on Applications of Algebraic Geometry. |
| January | Algebraic Vision Research Cluster, ICERM, Brown University. |

**2018**

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| December | Joint CUNY Graduate Center-Courant Seminar, Symbolic-Numeric Computing, City University of New York. |
| November | Mathematics, Information and Computation Seminar, Center for Data Science, New York University. |
| November | Nonlinear Algebra Seminar, ICERM, Brown University. |
| October | Math and Data Working Group at Center for Data Science, New York University. |
| October | AMS Sectional Meeting, Special Session on Extensions-Interpolation-Shape Matching in $\mathbb{R}^d$, Symmetry-Invariance, Algorithms and Related Topics, University of Michigan, Ann Arbor. |
| October | Dagstuhl Seminar, Shape Analysis: Euclidean, Discrete and Algebraic Geometric Methods, Leibniz-Zentrum für Informatik, Germany. |
| October | Joint KMS-DMV Mathematics Conference, Special Session on Algebraic Geometry and Computer Vision, Seoul, South Korea. |
| March | Simons Collaboration on Algorithms and Geometry, Simons Foundation, New York. |
| March | SIAM Southeastern Atlantic Sectional Conference, Special Session on Topics in the Mathematics of Data Analysis, University of North Carolina at Chapel Hill. |