Oscar Mickelin

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Employment

2025 –	**Tsinghua University, Yau Mathematical Sciences Center**. Assistant Professor
2021 – 2025	**Princeton University, Applied and Computational Mathematics**. Postdoctoral Research Associate

Education

Ph.D.	**Massachusetts Institute of Technology, Applied Mathematics**.
2016 – 2021	Affiliated with the department of mathematics and the Laboratory for Information and Decision Systems. **Advisor:** Sertac Karaman
M.Sc.	**California Institute of Technology, Mathematics**.
2015 – 2016	Transferred to MIT for PhD studies
M.Sc.	**Royal Institute of Technology and Stockholm University, Mathematics**.
2013 – 2015	**Advisor:** Ari Laptev
M.Sc.	**Royal Institute of Technology, Engineering Physics**.
2010 – 2015	
B.Sc.	**Royal Institute of Technology, Engineering Physics**.
2010 – 2013	

Publications

Journal articles

The listed publications below are from different subfields, with different author ordering conventions. Articles marked by $(\alpha\beta)$ indicate alphabetical authorship attribution.

[18] $(\alpha\beta)$ J. Kileel, **O. Mickelin**, A. Singer, and S. Xu, "Two Datasets Are Better Than One: Method of Double Moments for 3-D Reconstruction in Cryo-EM". Preprint: arXiv: 2511.07438.

[17] L. Zhang, **O. Mickelin**, S. Xu, A. Singer, "Diagonally-Weighted Generalized Method of Moments Estimation for Gaussian Mixture Modeling". Preprint: arXiv:2507.20459

[16] $(\alpha\beta)$ J. Hoskins, Y. Khoo, **O. Mickelin**, A. Singer, Y. Wang, "Subspace method of moments for ab initio 3-D single-particle Cryo-EM reconstruction". To appear in SIAM Journal on Imaging Sciences. Preprint: arXiv:2410.06889

[15] $(\alpha\beta)$ J. Kileel, N. F. Marshall, **O. Mickelin**, A. Singer, "Fast expansion into harmonics on the ball". SIAM Journal on Scientific Computing 47.2 (2025): A1117-A1144. Preprint: arXiv:2406.05922

[14] $(\alpha\beta)$ T. Bendory, D. Edidin, **O. Mickelin**, "The beltway problem over orthogonal groups". Applied and Computational Harmonic Analysis 74 (2025): 101723. Preprint: arXiv:2402.03787

[13] A. Adler, **O. Mickelin**, R. K. Ramachandran, G. S. Sukhatme, S. Karaman, "The Role of Heterogeneity in Autonomous Perimeter Defense Problems". The International Journal of Robotics Research. 2024;43(9):1363-1381. Invited journal version of conference paper below.

[12] A. Zhang, **O. Mickelin**, J. Kileel, E. Verbeke, N. Marshall, M.A. Gilles, A. Singer, "Moment-based metrics for molecules computable from cryo-EM images". Biological Imaging 4 (2024): e3. Preprint: arXiv:2401.15183

[11] $(\alpha\beta)$ N. F. Marshall, **O. Mickelin**, Y. Shi, A. Singer, "Fast principal component analysis for cryo-electron microscopy images." Biological Imaging 3 (2023): e2. Preprint: arXiv:2210.17501

[10] $(\alpha\beta)$ T. Bendory, Y. Khoo, J. Kileel, **O. Mickelin**, A. 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. Preprint: arXiv:2209.10531

[9] $(\alpha\beta)$ N. F. Marshall, **O. Mickelin**, A. Singer, "Fast expansion into harmonics on the disk: a steerable basis with fast radial convolutions". SIAM Journal on Scientific Computing, 45.5 (2023): A2431-A2457. Preprint: arXiv:2207.13674

[8] $(\alpha\beta)$ N. F. Marshall, **O. Mickelin**, "An optimal scheduled learning rate for a randomized Kaczmarz algorithm". SIAM Journal on Matrix Analysis and Applications 44 (1), 312-330. Preprint: arXiv:2202.12224

[7] **O. Mickelin**, S. Karaman, "Recovering orthogonal tensors under arbitrarily strong, but locally correlated, noise". Numerical Linear Algebra with Applications, 2022;e2479. Preprint: arxiv:2102.09661

[6] **O. Mickelin**, S. Karaman, "Multiresolution Low-rank Tensor Formats". SIAM Journal on Matrix Analysis and Applications, 41(3), 1086-1114. Preprint: arxiv:1908.11413

[5] **O. Mickelin**, S. Karaman, "On Algorithms for and Computing with the Tensor Ring Decomposition". Numerical Linear Algebra with Applications 27.3 (2020): e2289. Preprint: arxiv:1807.02513

[4] L. Yang, **O. Mickelin**, N. Ozay, "On sufficient conditions for mixed monotonicity". IEEE Transactions on Automatic Control, 64 (12), 2019. Preprint: arxiv:1803.04528

[3] **O. Mickelin***, J. Słomka*, K. J. Burns, D. Lecoanet, G. M. Vasil, L. Faria, and J. Dunkel, "Anomalous chained turbulence in actively driven flows on spheres". Phys. Rev. Lett., 120: 164503, 2018. Preprint: arxiv:1710.05525 *: authors contributed equally.

[2] **O. Mickelin**, "Lieb-Thirring inequalities for generalized magnetic fields". Bulletin of Mathematical Sciences, (2015), pp. 1–14.

[1] P.E. Olofsson, E. Forslund, B. Vanherberghen, K. Chechet, **O. Mickelin**, A. Rivera Ahlin, T. Everhorn and B. Önfelt, "Distinct migration and contact dynamics of resting and IL-2-activated human natural killer cells." Frontiers in Immunology 5 (2014).

Peer-reviewed conference proceedings

[4] M. Fraiman, P. Hoyos, T. Bendory, J. Kileel, **O. Mickelin**, N. Sharon, A. Singer, "SO(3)-invariant PCA with application to molecular data". To appear in the 2026 IEEE International Symposium on Biomedical Imaging. Preprint: arXiv:2510.18827

[3] A. Adler, **O. Mickelin**, R. K. Ramachandran, G. S. Sukhatme, S. Karaman, "The Role of Heterogeneity in Autonomous Perimeter Defense Problems". Algorithmic Foundations of Robotics XV WAFR 2022. Springer Proceedings in Advanced Robotics, vol 25. Preprint: arXiv:2202.10433 **Invited to submit an extended journal version to the International Journal of Robotics Research.**

[2] T. Bendory, **O. Mickelin**, A. Singer, "Sparse multi-reference alignment: sample complexity and computational hardness". In Proc. IEEE ICASSP 2022, pp. 8977–8981. Preprint: arxiv:2109.11656

[1] **O. Mickelin**, N. Ozay and R.M. Murray, "Synthesis of Correct-by-construction Control Protocols for Hybrid Systems Using Partial State Information". In Proc. of American Control Conference (ACC), 2014. **Best presentation award in its session.**

Talks

July 2025	SIAM Conference on Applied Algebraic Geometry, **invited talk**.
June 2025	CAMERA seminar, Lawrence Berkeley National Lab.
March 2025	SIAM Conference on Computational Science and Engineering, **invited talk**.
October 2024	Math & Data Seminar, University of Missouri, **invited talk**.
September 2024	Computational Harmonic Analysis in Data Science and Machine Learning, Casa Matematica Oaxaca, **invited talk**.
May 2024	SIAM Conference on Applied Linear Algebra, **invited talk**.
January 2024	Codes and Expansions (CodEx) Seminar, **invited talk**.
September 2023	AIP2023, 11th Applied Inverse Problems Conference, **invited talk**.
August 2023	ICIAM2023, 10th International Congress on Industrial and Applied Mathematics, **invited talk**.

May 2023	13th AIMS Conference on Dynamical Systems, Differential Equations and Applications, **invited talk**.
November 2022	Analysis seminar, SUNY Binghamton, **invited talk**.
October 2022	Seminar, University of Texas at Austin, **invited talk**.
May 2022	2022 IEEE International Conference on Acoustics, Speech and Signal Processing. Recorded talk and poster presentation..
May 2021	SIAM Conference on Applied Linear Algebra, **invited talk**.
February 2021	IDeAS Seminar, Princeton University.
June 2019	Group meeting talk, Sukhatme group, University of Southern California.
March 2017	70th New England Complex Fluids Workshop, Yale University.
June 2014	American Control Conference. **Best presentation award in its session**, **invited talk**.

Mentoring

Spring 2025	Diego Rubio Garcia, Junior paper.
January 2020	Einat Gavish, Directed Reading Program. One month mentoring in game theory.
Summer 2017	Silvia Casacuberta, Research Science Institute. **RSI Student Award for Best Presentation**.

Teaching Experience

2025 –	**Instructor**, *Tsinghua University*.
Fall 2025	Introduction to Finite Element Methods. Open course, not for credit.

2023 – 2025	**Instructor**, *Princeton University*.
Spring 2025	MAT 322/APC 350, Introduction to Differential Equations.
Spring 2024	MAT 322/APC 350, Introduction to Differential Equations.
Spring 2023	MAT 199/APC 199, Math Alive.

2017 – 2021	**Teaching Assistant**, *MIT*.
Spring 2021	Grader, 18.367, Waves and Imaging.
Spring 2021	Grader, 18.085/18.0851, Computational Science and Engineering I.
January 2020	Head TA, 18.02A, Calculus (multivariable).
Fall 2019	Head TA, 18.02A, Calculus (multivariable).
Fall 2019	Head TA, 18.01A, Calculus (single variable).
Fall 2018	TA, 18.02A, Calculus (multivariable).
Fall 2018	TA, 18.01A, Calculus (single variable).
Spring 2018	Beta tester for MITx: 18.033x, Differential Equations: Linear Algebra and $N \times N$ Systems of DEs.
Spring 2018	TA, 18.03, Differential Equations.
Fall 2017	TA, 18.085/18.0851, Computational Science and Engineering I.

2015 – 2016	**Teaching Assistant**, *California Institute of Technology*.
Spring 2016	TA, Ma1c analytical, Multivariable calculus.
Winter 2016	TA, Ma103/3, Introduction to Probability and Statistics.
Fall 2015	TA, Ma102/2, Differential Equations.

2012–2014	**Teaching Assistant**, *Royal Institute of Technology*.
Fall 2014	Grader, SF1628, Complex Analysis.
Fall 2013	Grader, SF1628, Complex Analysis.
Spring 2012	Resident tutor, substituting occasionally until Fall 2013.
Fall 2012	TA, SF1611, Introductory Course in Mathematics I.

Peer reviewing

I have served as a reviewer for:

Linear Algebra and its Applications, Information and Inference: A Journal of the IMA, SIAM Journal on Matrix Analysis and Applications, Journal of Machine Learning Research (JMLR), BIT Numerical Mathematics, Numerical Linear Algebra with Applications, IEEE Transactions on Automatic Control, IEEE Journal of Selected Topics in Signal Processing, IEEE Signal Processing Letters, IEEE Control Systems

Letters, IEEE International Symposium on Information Theory, American Control Conference (ACC), IEEE Conference on Decision and Control (CDC), Journal of Computational and Applied Mathematics, Neural Computing and Applications.

Additionally, I have written reviews for Mathematical Reviews.

Honors

Spring 2020	Charles and Holly Housman Award for Excellence in Teaching, 2020. Awarded for skill and dedication in undergraduate teaching.
Spring 2017	Kaufman Teaching Certificate Program alum at MIT.
Spring 2017	MIT Graduate School Leadership Institute alum.
Spring 2015	Recipient of the Stockholm Mathematics Centre Prize for Excellent Master Thesis the year 2014-2015.
Summer 2014	Recipient of "Best Presentation award" in my session during the 2014 American Control Conference.

updated January 2026.