Tyler Chen

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https://research.chen.pw

Positions

NYU Shanghai (上海纽约大学) ..... (2026-present)
Assistant Professor of Computer Science
- Division of Computer Science, Data Science, and Engineering

JPMorganChase ..... (2025-2026)
Vice President, Applied Research Lead
- Global Technology Applied Research, JPMorganChase

New York University ..... (2022-2025)
Assistant Professor / Courant Instructor
- Mathematics at Courant, Computer Science and Engineering at Tandon
- Sponsor: Christopher Musco

University of Washington ..... (2017-2021)
Academic Student Employee
- Instructor and Teaching Assistant (unionized with UAW Local 4121)

Education

University of Washington 2017-2022
Ph.D. in Applied Mathematics
- Thesis: *Lanczos-based methods for matrix functions*
- Advisors: Anne Greenbaum, Thomas Trogdon

University of Washington 2017-2019
M.Sc. in Applied Mathematics

Tufts University 2013-2017
B.S. Summa Cum Laude in Mathematics and Physics; Minor in Studio Art

Research Interests

I'm particularly interested in incorporating probabilistic techniques into classical algorithms to develop methods which are fast and reliable, both in theory and in practice. I hope that my work will help to bridge the gaps between numerical analysis, theoretical computer science, and the applied computational sciences, with the ultimate goal of supporting the advancement of knowledge in the basic sciences.

Monographs

Randomized Numerical Linear Algebra with Examples
Tyler Chen. 2025. [url].

- Online book providing a first introduction to RandNLA, with many accompanying numerical examples.

The Lanczos algorithm for matrix functions: a handbook for scientists
Tyler Chen. 2024. [arXiv].

- Accessible introduction to Lanczos-based methods for matrix functions, with a particular emphasis on conceptual understanding of the algorithm in finite precision arithmetic.

Papers

Hutch#: Optimal non-adaptive Frobenius norm estimation
Tyler Chen, Diana Halikias, Christopher Musco, and David Persson. 2026. [arXiv]

A simple stability analysis of the Lanczos algorithm in finite precision arithmetic
Tyler Chen. 2026. [arXiv]

Optimal near-optimality bounds for the Lanczos method for matrix functions
Tyler Chen and David Persson. 2026. [arXiv]

A recursive butterfly factorization with optimality guarantees
David Persson, Paul G. Beckman, Tyler Chen, Diana Halikias, and Christopher Musco. 2026. [arXiv]

Query Efficient Structured Matrix Learning
Noah Amsel, Pratyush Avi, Tyler Chen, Feyza Duman Keles, Chinmay Hegde, Christopher Musco, Cameron Musco, and David Persson. *Proceedings of Thirty Ninth Conference on Learning Theory*. 2026. [url] [arXiv]

Quasi-optimal Hierarchically Semi-separable Matrix Approximation
Noah Amsel, Tyler Chen, Feyza Duman Keles, Diana Halikias, Cameron Musco, Christopher Musco, and David Persson. *SIAM Journal on Matrix Analysis and Applications*. 2026. [url] [arXiv]

Preconditioning without a preconditioner using randomized block Krylov subspace methods
Tyler Chen, Caroline Huber, Ethan Lin, and Hajar Zaid. *ETNA - Electronic Transactions on Numerical Analysis*. 2026. [url] [arXiv]

Does block size matter in randomized block Krylov low-rank approximation?
Tyler Chen, Ethan N. Epperly, Raphael A. Meyer, Christopher Musco, and Akash Rao. *Proceedings of the 2026 Annual ACM-SIAM Symposium on Discrete Algorithms (SODA)*. 2026. [url] [arXiv]

Fixed-Sparsity Matrix Approximation from Matrix-Vector Products
Noah Amsel, Tyler Chen, Feyza Duman Keles, Diana Halikias, Cameron Musco, and Christopher Musco. *SIAM Journal on Matrix Analysis and Applications*. 2026. [url] [arXiv]

A simple analysis of a quantum-inspired algorithm for solving low-rank linear systems

Tyler Chen, Junhyung Lyle Kim, Archan Ray, Shouvanik Chakrabarti, Dylan Herman, and Niraj Kumar. 2025. [arXiv]

Provably faster randomized and quantum algorithms for k-means clustering via uniform sampling
Tyler Chen, Archan Ray, Akshay Seshadri, Dylan Herman, Bao Bach, Pranav Deshpande, Abhishek Som, Niraj Kumar, and Marco Pistoia. 2025. [arXiv]

GPU-Parallelizable Randomized Sketch-and-Precondition for Linear Regression using Sparse Sign Sketches
Tyler Chen, Pradeep Niroula, Archan Ray, Pragna Subrahmanya, Marco Pistoia, and Niraj Kumar. *27th IEEE International Workshop on Parallel and Distributed Scientific and Engineering Computing (PDSEC 2026) (to appear)*. 2025. [arXiv].

- workshop best paper

Randomized block-Krylov subspace methods for low-rank approximation of matrix functions
David Persson, Tyler Chen, and Christopher Musco. *Linear Algebra and its Applications*. 2026. [url] [arXiv]

A Unified Framework for Provably Efficient Algorithms to Estimate Shapley Values
Tyler Chen, Akshay Seshadri, Mattia J. Villani, Pradeep Niroula, Shouvanik Chakrabarti, Archan Ray, Pranav Deshpande, Romina Yalovetzky, Marco Pistoia, and Niraj Kumar. *Advances in Neural Information Processing Systems*. 2025. [url] [arXiv]

Optimal Polynomial Approximation to Rational Matrix Functions Using the Arnoldi Algorithm
Tyler Chen, Anne Greenbaum, and Natalie Wellen. *Numerical Algorithms*. 2025. [url] [arXiv]

Randomized Matrix-Free Quadrature: Unified and Uniform Bounds for Stochastic Lanczos Quadrature and the Kernel Polynomial Method
Tyler Chen, Thomas Trogdon, and Shashanka Ubaru. *SIAM Journal on Scientific Computing*. 2025. [url] [arXiv]

Near-optimal hierarchical matrix approximation from matrix-vector products
Tyler Chen, Feyza Duman Keles, Diana Halikias, Cameron Musco, Christopher Musco, and David Persson. *Symposium on Discrete Algorithms (SODA)*. 2025. [url] [arXiv]

Nearly Optimal Approximation of Matrix Functions by the Lanczos Method
Noah Amsel, Tyler Chen, Anne Greenbaum, Cameron Musco, and Christopher Musco. *Conference on Neural Information Processing (NeurIPS)*. 2024. [url] [arXiv].

- invited for spotlight presentation.

Faster Randomized Partial Trace Estimation
Tyler Chen, Robert Chen, Kevin Li, Skai Nzeuton, Yilu Pan, and Yixin Wang. *SIAM Journal on Scientific Computing*. 2024. [url] [arXiv]

Near-optimal convergence of the full orthogonalization method
Tyler Chen and Gérard Meurant. *ETNA - Electronic Transactions on Numerical Analysis*. 2024. [url] [arXiv]

On the fast convergence of minibatch heavy ball momentum
Raghu Bollapragada, Tyler Chen, and Rachel Ward. *IMA Journal of Numerical Analysis*. 2024. [url] [arXiv]

GMRES, pseudospectra, and Crouzeix's conjecture for shifted and scaled Ginibre matrices
Tyler Chen, Anne Greenbaum, and Thomas Trogdon. *Mathematics of Computation*. 2024. [url] [arXiv]

A posteriori error bounds for the block-Lanczos method for matrix function approximation
Qichen Xu and Tyler Chen. *Numerical Algorithms*. 2024. [url] [arXiv]

Stability of the Lanczos algorithm on matrices with regular spectral distributions
Tyler Chen and Thomas Trogdon. *Linear Algebra and its Applications*. 2024. [url] [arXiv]

A spectrum adaptive kernel polynomial method
Tyler Chen. *The Journal of Chemical Physics*. 2023. [url] [arXiv].

- This approach is implemented in the `spectral_density` package

Krylov-Aware Stochastic Trace Estimation
Tyler Chen and Eric Hallman. *SIAM Journal on Matrix Analysis and Applications*. 2023. [url] [arXiv]

Low-Memory Krylov Subspace Methods for Optimal Rational Matrix Function Approximation
Tyler Chen, Anne Greenbaum, Cameron Musco, and Christopher Musco. *SIAM Journal on Matrix Analysis and Applications*. 2023. [url] [arXiv]

Numerical computation of the equilibrium-reduced density matrix for strongly coupled open quantum systems
Tyler Chen and Yu-Chen Cheng. *The Journal of Chemical Physics*. 2022. [url] [arXiv]

Error Bounds for Lanczos-Based Matrix Function Approximation
Tyler Chen, Anne Greenbaum, Cameron Musco, and Christopher Musco. *SIAM Journal on Matrix Analysis and Applications*. 2022. [url] [arXiv]

Analysis of stochastic Lanczos quadrature for spectrum approximation
Tyler Chen, Thomas Trogdon, and Shashanka Ubaru. *International Conference on Machine Learning (ICML)*. 2021. [url] [arXiv].

- invited for long presentation

On the Convergence Rate of Variants of the Conjugate Gradient Algorithm in Finite Precision Arithmetic
Anne Greenbaum, Hexuan Liu, and Tyler Chen. *SIAM Journal on Scientific Computing*. 2021. [url] [arXiv]

Non-asymptotic moment bounds for random variables rounded to non-uniformly spaced sets
Tyler Chen. *Stat*. 2021. [url] [arXiv]

Predict-and-recompute conjugate gradient variants
Tyler Chen and Erin C. Carson. *SIAM Journal on Scientific Computing*. 2020. [url] [arXiv].

- abridged version was Student Paper Competition winner at 16$^{\text{th}}$ Copper Mountain Conference on Iterative Methods

Student Mentoring

Robert Chen (NYU) ..... 2023 - 2025
Caroline Huber (NYU) ..... 2024 - 2025
Ethan Lin (NYU) ..... 2024 - 2025
Devin Tang (NYU) ..... 2024 - 2025
Hajar Zaid (Graduate Center CUNY) ..... 2024 - 2025
Ginebra Ferreira (NYU) ..... summer 2024
Kevin Li (NYU) ..... 2022 - 2024
Yixin Wang (NYU) ..... 2023 - 2024
Yue Geng (NYU) ..... summer/fall 2023
Ismael Jimenez (NYU) ..... summer 2023
Skai Nzeuton (Stuyvesant High School) ..... 2022 - 2023
Yilu Pan (NYU Shanghai) ..... 2022 - 2023
Qichen Xu (UW) ..... 2021 - 2023
Linda Zhao (NYU) ..... summer/fall 2023
Aeron Langford (UW) ..... autumn 2019

Teaching

Instructor

Machine Learning (CSCI-SHU 360) ..... spring 2027
Experience Studio: AI Thinking (PCIX-SHU 102) ..... winter 2027
Topics in Computer Science: AI Thinking (CSCI-SHU 205) ..... fall 2026
Numerical Analysis (NYU MATH-UA 252) ..... fall 2024
Linear Algebra I (NYU MATH-GA 2110) ..... spring 2024
Numerical Analysis (NYU MATH-UA 252) ..... fall 2023
Numerical Analysis (NYU MATH-UA 252) ..... spring 2023
Mathematical Statistics (NYU MATH-UA 234) ..... fall 2022
Applied Linear Algebra and Numerical Analysis (UW AMATH 352) ..... spring 2021
Interdisciplinary Writing/Natural Science (UW ENGL 199) ..... winter 2021
Interdisciplinary Writing/Natural Science (UW ENGL 199) ..... autumn 2020

TA or Grader

Probability and Statistics for Computational Finance, TA (UW CFRM 410) ..... winter 2019
Calculus with Analytic Geometry I, TA (UW MATH 124) ..... autumn 2018
Calculus with Analytic Geometry II, TA (UW MATH 12) ..... winter 2018
Calculus with Analytic Geometry II, TA (UW MATH 125) ..... autumn 2017
Electronics, TA (Tufts PHY 41) ..... spring 2017

Electronics, TA (Tufts PHY 41) ..... spring 2016
Discrete Mathematics, Grader (Tufts MATH 61) ..... spring 2016
Calculus III, Grader (Tufts MATH 42) ..... fall 2015
Differential Equations, Grader (Tufts MATH 51) ..... spring 2015
Calculus III, Grader (Tufts MATH 42) ..... fall 2014

Talks and Posters

City College of New York, Presentation 2026
NYU Shanghai, Presentation [pdf] 2026
Workshop on Randomized Numerical Linear Algebra, Presentation [pdf][video] 2026
Workshop on Linear Systems and Eigenvalue Problems, Presentation [pdf][video] 2025
Householder XXII, Presentation [pdf] 2025
Joint Math Meetings, Presentation [pdf] 2025
Mid-Atlantic Numerical Analysis Day, Presentation [pdf] 2024
NYU Theory Seminar, Presentation [pdf] 2024
Precond, Presentation [pdf] 2024
SIAM Linear Algebra, Presentation [pdf] 2024
Georgia Tech, Presentation [pdf] 2024
NYU Math Modeling workshop, Presentation 2023
NYU Math Society meeting, Presentation 2023
SIAM New York, New Jersey, and Pennsylvania Annual Meeting, Presentation [pdf] 2023
Universität Bielefeld, Presentation [pdf] 2023
NYU Shanghai, Presentation [pdf] 2023
International Congress on Industrial and Applied Mathematics, Presentation [pdf] 2023
Sampling Theory and Applications Conference, Presentation [pdf] 2023
Foundations of Computational Mathematics, Presentation [pdf] 2023
Perspectives on Matrix Computations, Presentation [pdf] 2023
Courant Numerical Analysis and Scientific Computing Seminar, Presentation [pdf] 2022
Conference on Random Matrix Theory and Numerical Linear Algebra, Presentation [pdf] 2022
Workshop on Algorithms for Large Data (Online), Poster [pdf] 2021
International Conference on Machine Learning, Oral [video] 2021
SIAM Linear Algebra 21, Presentation [pdf] 2021
Baidu Research, Presentation [pdf] 2021
Householder Symposium, Poster (Cancelled) 2020
Copper Mountain Student Paper Award Session, Presentation (Cancelled) 2020
SIAM Parallel Processing, Presentation [pdf] 2020
Baidu Research, Presentation 2019

Service and Outreach

Committees

AI Committee: Teaching, Learning and Student Engagement (NYU Shanghai) ..... 2026 - present
Writing Committee Task Force (NYU Shanghai) ..... 2026 - present
PhD Committee (NYU Shanghai CSDSE) ..... 2026 - present
Graduate Student Representative (UW Applied Math) ..... 2019 - 2020

Conference Organization

Minisymposium: Numerical Linear Algebra as an Art (SIAM LA27) ..... may 2027
Minisymposium: Random matrices and numerical linear algebra [program] (SIAM LA21) . may 2021
Minisymposium: High performance Krylov subspace methods [program] (SIAM PP20) .... feb. 2020

Student Groups, Panels, and Mentoring

Panelist, Financial Literacy Workshop (NYUSH EmpowerU) ..... october 2026
Faculty mentor for first-generation students (NYUSH EmpowerU) ..... 2026 - present
Panelist, university grad school pannel for seniors (NYUSH) ..... october 2026
Postdoc career discussion (SIAM UW) ..... june 2026
Industry career discussion (Tufts SIAM) ..... jan. 2026
Faculty mentor for first-generation students (NYU Proud to Be First Faculty Connect) ..... 2023 - 2024
Tutorial on randomized linear algebra (NYU Math Modeling Workshop) ..... nov. 2023
Chalkboard talk on randomized linear algebra (NYU Math Society) ..... nov. 2023
Podcast guest: path as a mathematician, advice for students (NYU SIAM) ..... oct. 2023
Panelist, grad school info session (NYU SIAM) ..... oct. 2022
Panelist, departmental climate orientation (UW Diversity Committee) ..... oct. 2019
Organizer, weekly Numerical Analysis Research Club (UW NARC) ..... 2019 - 2020
Organizer, mental health conversation and resources (SIAM UW) ..... oct. 2018

Software

Research code (https://github.com/tchen-research)
Repositories with code to generate figures and experiments from my papers.

Spectral Density (https://pypi.org/project/spectral-density/)
Develop `spectral_density` package to efficiently produce spectrum adaptive KPM approximations.

PETSc (https://www.mcs.anl.gov/petsc/)
Contribute PIPEPRCG. This method can be used by with the flag `-ksp_type pipeprcg`.

mpmath (https://github.com/mpmath)
Update matrix multiplication driver to significantly improve performance for sparse matrices.

Awards & Honors

Boeing Research Award (UW Department of Applied Mathematics) 2020
Student Paper Competition Winner (Copper Mountain Conference on Iterative Methods) 2020
Graduate Research Fellowship (NSF) 2019
Top Scholars Fellowship (UW) 2017
The Audrey Butvay Gruss Science Award (Tufts) 2017
Phi Beta Kappa (Tufts) 2017
Sigma Pi Sigma Physics Honors Society (Tufts) 2016
The Howard Sample Prize Scholarship in Physics (Tufts) 2015