

# Yifan Chen

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Updated Oct, 2024

## EMPLOYMENT

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**Courant Institute, New York University**

Assistant Professor/Courant Instructor

New York, NY

2023/9–

## EDUCATION

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**California Institute of Technology**

Ph.D. in Applied and Computational Mathematics

Advisors: Thomas Y. Hou, Houman Owhadi, Andrew M. Stuart

Pasadena, California

2018–2023

**Tsinghua University**

B.S. in Pure and Applied Mathematics, GPA ranked 1st

Beijing, China

2014–2018

## RESEARCH INTERESTS

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My research involves analyzing and developing algorithms for high-dimensional statistical and computational problems in physics, data science, and machine learning, with a focus on partial differential equations, multiscale and statistical numerical methods, Bayesian inference, and the sampling and learning of probability distributions.

## PUBLICATIONS

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### Preprints

- [1] Yifan Chen, Xiaoou Cheng, Jonathon Niles-Weed, Jonathon Weare. Convergence of Unadjusted Langevin in High Dimensions: Delocalization of Bias. *arxiv: 2408.13115*, 2024.
- [2] José A. Carrillo, Yifan Chen, Daniel Zhengyu Huang, Jiaoyang Huang, Dongyi Wei. Fisher-Rao Gradient Flow: Geodesic Convexity and Functional Inequalities. *arxiv: 2407.15693*, 2024
- [3] Yifan Chen, Bamdad Hosseini, Houman Owhadi, Andrew M. Stuart. Gaussian Measures Conditioned on Nonlinear Observations: Consistency, MAP Estimators, and Simulation. *arxiv: 2405.13149*, 2024
- [4] Huan Zhang, Yifan Chen, Eric Vanden-Eijnden, Benjamin Peherstorfer. Sequential-in-time training of nonlinear parametrizations for solving time-dependent partial differential equations. *arxiv: 2404.01145*, 2024
- [5] Yifan Chen, Daniel Zhengyu Huang, Jiaoyang Huang, Sebastian Reich, Andrew M. Stuart. Sampling via Gradient Flows in the Space of Probability Measures. *arxiv: 2310.03597*, 2023
- [6] Yifan Chen, Ethan N. Epperly, Joel A. Tropp, and Robert J. Webber. Randomly pivoted Cholesky: Practical approximation of a kernel matrix with few entry evaluations. *arXiv:2207.06503*, 2022.

### Conference publications

- [1] Yifan Chen, Mark Goldstein, Mengjian Hua, Michael S. Albergo, Nicholas M. Boffi, Eric Vanden-Eijnden. Probabilistic Forecasting with Stochastic Interpolants and Föllmer Processes. *ICML*, 2024.

- [2] Xinzhe Dai, Peichen Zhong, Bowen Deng, Yifan Chen, and Gerbrand Ceder. Inpainting crystal structure generations with score-based denoising. *ICML Workshop AI4Science*, 2024.
- [3] Zihui Wu, Yu Sun, Yifan Chen, Bingliang Zhang, Yisong Yue, Katherine L. Bouman. Principled Probabilistic Imaging using Diffusion Models as Plug-and-Play Priors. *NeurIPS*, 2024

### Journal publications

- [1] Yifan Chen, Daniel Zhengyu Huang, Jiaoyang Huang, Sebastian Reich, Andrew M. Stuart. Efficient, Multimodal, and Derivative-Free Bayesian Inference With Fisher-Rao Gradient Flows. *Inverse Problems*, 2024
- [2] Pau Batlle, Yifan Chen, Bamdad Hosseini, Houman Owhadi, Andrew M. Stuart. Error Analysis of Kernel/GP Methods for Nonlinear and Parametric PDEs. *Journal of Computational Physics*, 2024.
- [3] Yu Sun, Zihui Wu, Yifan Chen, Berthy T. Feng, Katherine L. Bouman. Provable Probabilistic Imaging using Score-Based Generative Priors. *IEEE Transactions on Computational Imaging*, 2024.
- [4] Yifan Chen, Houman Owhadi, Florian Schaefer. Sparse Cholesky Factorization for Solving Nonlinear PDEs via Gaussian Processes. *Mathematics of Computation*, 2024.
- [5] Yifan Chen, Thomas Y. Hou, and Yixuan Wang. Exponentially convergent multiscale methods for 2D high frequency heterogeneous Helmholtz equations. *SIAM Multiscale Modeling & Simulation*, 21(3): 849–883, 2023.
- [6] Yifan Chen, Thomas Y. Hou, and Yixuan Wang. Exponentially convergent multiscale finite element method. *Communications on Applied Mathematics and Computation*, 1–17, 2023.
- [7] Yifan Chen and Thomas Y. Hou. Multiscale elliptic PDE upscaling and function approximation via subsampled data. *SIAM Multiscale Modeling & Simulation*, 20(1):188–219, 2022.
- [8] Yifan Chen, Bamdad Hosseini, Houman Owhadi, and Andrew M. Stuart. Solving and learning nonlinear PDEs with Gaussian processes. *Journal of Computational Physics*, 447:110668, 2021.
- [9] Yifan Chen, Houman Owhadi, and Andrew M. Stuart. Consistency of empirical Bayes and kernel flow for hierarchical parameter estimation. *Mathematics of Computation*, 90(332):2527–2578, 2021.
- [10] Yifan Chen, Thomas Y. Hou, and Yixuan Wang. Exponential convergence for multiscale linear elliptic PDEs via adaptive edge basis functions. *SIAM Multiscale Modeling & Simulation*, 19(2):980–1010, 2021.
- [11] Yifan Chen and Thomas Y. Hou. Function approximation via the subsampled Poincaré inequality. *Discrete & Continuous Dynamical Systems-A*, 41(1), 2021.
- [12] Yifan Chen and Wuchen Li. Optimal transport natural gradient for statistical manifolds with continuous sample space. *Information Geometry*, 3(1):1–32, 2020.
- [13] Yifan Chen, Yuejiao Sun, and Wotao Yin. Run-and-Inspect Method for nonconvex optimization and global optimality bounds for R-local minimizers. *Mathematical Programming*, 176(1): 39–67, 2019.
- [14] Jing Chen, Yifan Chen, Hao Wu, and Dinghui Yang. The quadratic Wasserstein metric for earthquake location. *Journal of Computational Physics*, 373:188–209, 2018.

## TEACHING

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### Instructor at NYU Courant

- Discrete Mathematics Fall 2023
- Discrete Mathematics Spring 2024
- Numerical Analysis Fall 2024

### Teaching Assistant at Caltech

- ACM 109: Mathematical Modeling Spring 2021
- ACM 118: Stochastic Processes and Regression Winter 2020
- ACM 117: Probability and Stochastic Processes Fall 2020
- ACM 109: Mathematical Modeling Spring 2020

## INDUSTRIAL EXPERIENCES

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### **Citadel Securities**

Quantitative Research Intern

Miami, Florida

6/2022-8/2022

- Project on Alpha Research: Predicting APAC Market Returns

### **Microsoft**

Part Time Researcher, Mentor: Pengchuan Zhang

(virtual) Redmond, Washington

9/2021-2/2022

- Project: Stabilizing Large Scale Neural Network Training of Vision Transformers

## REFEREE SERVICES

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- Reviewer for NeurIPS 2024
- Reviewer for Journal of Functional Analysis
- Reviewer for Mathematics of Computation
- Reviewer for Journal of Computational Physics
- Reviewer for SIAM on Uncertainty Quantification
- Reviewer for SIAM on Control and Optimization
- Reviewer for SIAM on Numerical Analysis
- Reviewer for SIAM on Multiscale Modeling and Simulation
- Reviewer for Linear Algebra and Its Applications
- Reviewer for Research in the Mathematical Sciences
- Reviewer for European Journal of Applied Mathematics
- Reviewer for Nature Machine Intelligence
- Reviewer for IMA Journal of Numerical Analysis
- Reviewer for Foundations of Data Science
- Reviewer for Computational Methods in Applied Mathematics
- Reviewer for International Journal of Computer Mathematics
- Reviewer for the 4th International Conference on Geometric Science of Information

## CONFERENCES AND SEMINARS

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- Co-organizing the minisymposium “Efficient computation and learning with randomized sampling and pruning” at the SIAM Conference on Mathematics of Data Science (MDS24), Atlanta, Georgia, Oct 2024
- Recent Advances and Future Directions for Sampling, Yale University, New Haven, Oct 2024
- Data Science Seminar, Department of Mathematics, University of Minnesota, Oct 2024
- Rising Stars in Computing for Science and Engineering, Harvard University, Sep 2024
- Computational Bayesian Statistics Journal Club, Flatiron Institute, New York, Sep, 2024
- Applied Mathematics Seminar, Nanyang Technology University, July, 2024

- International Conference on Scientific Computation and Differential Equations, National University of Singapore, July, 2024
- Conference on Multiscale Modeling based on Physics and Data, IPAM, UCLA, April, 2024
- Columbia Applied Math Colloquium, January, 2024
- Workshop on Scientific Computing and Large Data, University of South Carolina, Dec, 2023
- Numerical Analysis Seminar (virtual), Hong Kong University, Dec, 2023
- Measure Transport, Diffusion Processes and Sampling Workshop, Flatiron, New York, Dec, 2023
- Yau Mathematical Science Center CAM seminar, Tsinghua University (virtual), Nov, 2023
- International Workshop on Recent Developments in Applied Mathematics and its Applications, Caltech, Nov, 2023
- Scientific machine learning seminar, Courant Institute, Oct, 2023
- 17th U. S. National Congress on Computational Mechanics, Albuquerque, New Mexico, July 2023
- Mathematical and Scientific Machine Learning, ICERM, Providence, June, 2023
- The AIMS Conference on Dynamical Systems, Differential Equations and Applications, Wilmington, North Carolina, May 2023
- Southern California Applied Mathematics Symposium, University of California, Irvine, April 2023
- Peking University applied math colloquium (virtual), Feb, 2023.
- Columbia applied math colloquium (virtual), January, 2023.
- The International Conference on New Trends in Computational and Data Sciences, Caltech, December 2022.
- Co-organizing the minisymposium “Recent Advances in Kernel Methods for Computing and Learning” in SIAM Mathematics of Data Science, San Diego, September, 2022.
- Southern California Applied Mathematics Symposium, Harvey Mudd College, May, 2022
- Rough Path Interest Group, The Alan Turing Institute (virtual), April, 2022
- SIAM Uncertainty Quantification Minisymposium “New Developments in Gaussian Processes”, Atlanta, April 2022
- CMX Student and Postdoc Seminar, Caltech, November, 2020
- Second Symposium on Machine Learning and Dynamical Systems, Fields Institute (virtual), September, 2020
- Bernoulli-IMS One World Symposium (virtual), August, 2020
- Oberwolfach Seminar: Beyond Numerical Homogenization, June, 2019
- Machine Learning for Multiscale Model Reduction Workshop, Harvard University, March, 2019
- Mathematical Model and Computation of Nonlinear Problems, Tsinghua Sanya International Mathematics Forum, January, 2018
- Youth Forum in the 15th Annual Meeting of CSIAM, Qingdao, China, October, 2017

## SCHOLARSHIPS AND AWARDS

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| • The W.P. Carey and Co. Prize in Applied Mathematics, 2023, Caltech                             | 2023      |
| • Kortschak Scholars Program, Department of Computational and Mathematical Sciences, Caltech     | 2018–2023 |
| • Tsinghua Xuetang Mathematics Program, Department of Mathematical Sciences, Tsinghua University | 2015–2018 |
| • Outstanding Undergraduate, Tsinghua University and Beijing                                     | 2018      |
| • Baosteel Scholarship, Baosteel Corporation   | 2017      |
| • Scholarship in Memory of the “12.9” Student Movement, Tsinghua University                      | 2016      |
| • Qualcomm Scholarship, Qualcomm Corporation   | 2016      |
| • Scholarship in Memory of Mathematics Professor Ou Li, Tsinghua University                      | 2016      |
| • National Scholarship, Ministry of Education of China   | 2015      |

## COMPUTER SKILLS

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Professional experiences in MATLAB, LaTeX, Python, Julia.

## LANGUAGES

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English (fluent), Chinese (native)