Nikola B. Kovachki

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EDUCATION

California Institute of Technology
Pasadena, CA, USA

- Ph.D. in Applied and Computational Mathematics — Oct 2016 – Jun 2022
  - Adviser: Prof. Andrew M. Stuart
  - Thesis: Machine Learning and Scientific Computing
- B. Sc. in Mathematics — Oct 2012 – Jun 2016

PROFESSIONAL EXPERIENCE

New York University
Courant Institute School of Mathematics, Computing, and Data Science
New York, NY, USA

- *Assistant Professor of Mathematics* — Sep 2026 – Present

NVIDIA Corporation
NVIDIA Research
Santa Clara, CA, USA

- *Senior Research Scientist* — Mar 2026 – Present
- *Research Scientist* — Aug 2022 – Mar 2026

TEACHING

New York University
Courant Institute School of Mathematics, Computing, and Data Science
New York, NY, USA

- *Assistant Professor of Mathematics* — Sep 2026– Present
  - Linear and Nonlinear Optimization (MATH-UA 353)

California Institute of Technology
Computing and Mathematical Sciences
Pasadena, CA, USA

- *Visiting Instructor* — Sep 2023– Dec 2023
  - Approximation Theory and Neural Networks (ACM 270-1)

AWARDS

- Amazon AI4Science Fellowship — 2020 – 2021
- Computing and Mathematical Sciences Graduate Student Fellowship — 2016 – 2017

PUBLICATIONS

JOURNAL PUBLICATIONS

[1] Liu-Schiaffini M., Singer C.E., Kovachki N.B., Leung S.C., Bae H.J., Azizzadenesheli K., Anandkumar A., "Tipping point forecasting in nonstationary dynamics on function spaces," *Proceedings of the National Academy of Sciences*, vol. 123, no. 42, (2026).

[2] Kossaifi J., Kovachki N.B., Li Z., Pitt D., Liu-Schiaffini M., George R.J., Bonev B., Azizzadenesheli K., Berner J., Duruisseaux V., Anandkumar A., "A Library for Learning Neural Operators," *Journal of Machine Learning Research*, vol. 27, no. 205, (2026).

[3] Wu R., Kovachki N.B., Liu B., "A Learning-based Domain Decomposition Method," *Computer Methods in Applied Mechanics and Engineering*, vol. 453, (2026).

[4] Calvello E., Kovachki N.B., Levine M.E., Stuart A.M., "Continuum Attention for Neural Operators," *Journal of Machine Learning Research*, vol. 26, no. 300, (2025).

[5] Li X., Li Z., Kovachki N.B., Anandkumar A., "Geometric Operator Learning with Optimal Transport," *Journal of Machine Learning Research*, vol. 26, no. 282, (2025).

[6] Lim J.H., Kovachki N.B., Baptista R., Beckham C., Azizzadenesheli K., Kossaifi J., Voleti V., Song J., Kreis K., Kautz J., Pal C., Vahdat A., Anandkumar A., "Score-Based Diffusion Models in Function Space," *Journal of Machine Learning Research*, vol. 26, no. 158, (2025).

[7] Baptista R., Hosseini B., Kovachki N.B., Marzouk Y.M., Sagiv A., "An Approximation Theory Framework for Measure-Transport Sampling Algorithms," *Mathematics of Computation*, vol. 94, no. 354, (2025).

[8] Zheng H., Chu W., Wang A., Kovachki N.B., Baptista R., Yue Y., "Ensemble Kalman Diffusion Guidance: A Derivative-free Method for Inverse Problems," *Transactions on Machine Learning Research*, (2025).

[9] Baptista R., Hosseini B., Kovachki N.B., Marzouk Y., "Conditional Sampling with Monotone GANs: from Generative Models to Likelihood-Free Inference," *SIAM/ASA Journal on Uncertainty Quantification*, vol. 12, no. 3, (2024).

[10] Kossaifi J., Kovachki N.B., Azizzadenesheli K., Anandkumar A., "Multi-Grid Tensorized Fourier Neural Operator for High-Resolution PDEs," *Transactions on Machine Learning Research*, (2024).

[11] Bhattacharya K., Kovachki N.B., Rajan A., Stuart A.M., Trautner M., "Learning Homogenization for Elliptic Operators," *SIAM Journal on Numerical Analysis*, vol. 62, no. 4, (2024).

[12] Li Z., Zheng H., Kovachki N.B., Jin D., Chen H., Liu B., Azizzadenesheli K., Anandkumar A., "Physics-Informed Neural Operator for Learning Partial Differential Equations," *ACM/IMS Journal of Data Science*, vol. 1, no. 3, (2024).

[13] Kovachki N.B., Lanthaler S., Stuart A.M., "Operator Learning: Algorithms and Analysis," *Handbook of Numerical Analysis*, vol. 25, (2024).

[14] Azizzadenesheli K., Kovachki N.B., Li Z., Liu-Schiaffini M., Kossaifi J., Anandkumar A., "Neural Operators for Accelerating Scientific Simulations and Design," *Nature Reviews Physics*, vol. 6, no. 5, (2024).

[15] de Hoop M.V., Kovachki N.B., Nelsen N.H., Stuart A.M., "Convergence Rates for Learning Linear Operators from Noisy Data," *SIAM/ASA Journal on Uncertainty Quantification*, vol. 11, no. 2, (2023).

[16] Kovachki N.B., Li Z., Liu B., Azizzadenesheli K., Bhattacharya K., Stuart A., Anandkumar A., "Neural Operator: Learning Maps Between Function Spaces With Applications to PDEs," *Journal of Machine Learning Research*, vol. 24, no. 89, (2023).

[17] Kovachki N.B., Liu B., Sun X., Zhou H., Bhattacharya K., Ortiz M., Stuart A., "Multiscale Modeling of Materials: Computing, Data Science, Uncertainty and Goal-oriented Optimization," *Mechanics of Materials*, vol. 165, (2022).

[18] Liu B., Kovachki N.B., Li Z., Azizzadenesheli K., Anandkumar A., Stuart A., Bhattacharya K., "A Learning-based Multiscale Method and its Application to Inelastic Impact Problems," *Journal of the Mechanics and Physics of Solids*, vol. 158, (2022).

[19] Kovachki N.B., Lanthaler S., Mishra S., "On Universal Approximation and Error Bounds for Fourier Neural Operators," *Journal of Machine Learning Research*, vol. 22, no. 290, (2021).

[20] Bhattacharya K., Hosseini B., Kovachki N.B., Stuart A.M., "Model Reduction and Neural Networks for Parametric PDEs," *The SMAI journal of computational mathematics*, vol. 7, (2021).

[21] Kovachki N.B., Stuart A.M., "Continuous Time Analysis of Momentum Methods," *Journal of Machine Learning Research*, vol. 22, no. 17, (2021).

[22] Cheng L., Kovachki N.B., Welborn M., Miller T.F. III, "Regression Clustering for Improved Accuracy and Training Costs with Molecular-Orbital-Based Machine Learning," *Journal of Chemical Theory and Computation*, vol. 15, no. 12, (2019).

[23] Kovachki N.B., Stuart A.M., "Ensemble Kalman Inversion: a Derivative-free Technique for Machine Learning Tasks," *Inverse Problems*, vol. 35, no. 9, (2019).

REFEREED CONFERENCE PROCEEDINGS

[24] Zheng H., Chu W., Zhang B., Wu Z., Wang A., Feng B.T., Zou C., Sun Y., Kovachki N.B., Ross Z.E., Bouman K.L., Yue Y., "InverseBench: Benchmarking Plug-and-Play Diffusion Priors for Inverse Problems in Physical Sciences," *International Conference on Learning Representations*, (2025).

[25] Tu R., White C., Kossaifi J., Bonev B., Kovachki N.B., Pekhimenko G., Azizzadenesheli K., Anandkumar A., "Guaranteed Approximation Bounds for Mixed-Precision Neural Operators," *International Conference on Learning Representations*, vol. 2024, (2024).

[26] Daras G., Nie W., Kreis K., Dimakis A., Mardani M., Kovachki N.B., Vahdat A., "Warped Diffusion: Solving Video Inverse Problems with Image Diffusion Models," *Advances in Neural Information Processing Systems*, vol. 37, (2024).

[27] Li Z., Kovachki N.B., Choy C., Li B., Kossaifi J., Otta S.P., Nabian M.A., Stadler M., Hundt C., Azizzadenesheli K., Anandkumar A., "Geometry-Informed Neural Operator for Large-Scale 3D PDEs," *Advances in Neural Information Processing Systems*, vol. 36, (2023).

[28] Li Z., Liu-Schiaffini M., Kovachki N.B., Azizzadenesheli K., Liu B., Bhattacharya K., Stuart A., Anandkumar A., "Learning Chaotic Dynamics in Dissipative Systems," *Advances in Neural Information Processing Systems*, vol. 35, (2022).

[29] Li Z., Kovachki N.B., Azizzadenesheli K., Liu B., Bhattacharya K., Stuart A., Anandkumar A., "Fourier Neural Operator for Parametric Partial Differential Equations," *International Conference on Learning Representations*, (2021).

[30] Li Z., Kovachki N.B., Azizzadenesheli K., Liu B., Bhattacharya K., Stuart A., Anandkumar A., "Multipole Graph Neural Operator for Parametric Partial Differential Equations," *Advances in Neural Information Processing Systems*, vol. 33, (2020).

WORKSHOP PAPERS

[31] Ahn D., Chandran S., Leibovici D., Kovachki N.B., Papalexakis E.E., Kossaifi J., "Lightweight Fourier Neural Operator for Time-Dependent Partial Differential Equations," *Machine Learning and the Physical Sciences Workshop at NeurIPS*, (2025).

PREPRINTS

[32] Leibovici D., Kovachki N.B., Ahn D., Ohana R., Shokar I.J.S., Ghasemi A., Akkurt S., Ranade R., Ashton N., Kautz J., Kossaifi J., "CANTO: CAD-Native Transformer Operators for AI-Aided Engineering," arXiv:2609.36806, (2026).

[33] Calvello E., Carlson E., Kovachki N.B., Manta M.N., Stuart A.M., "Formulation and Learning Of The Forecasting Problem," arXiv:2603.20359, (2026).

[34] Kossaifi J., Kovachki N.B., Mardani M., Leibovici D., Ravuri S., Shokar I., Calvello E., Abbas M.S., Harrington P., Subramaniam A., Brenowitz N., Bonev B., Byeon W., Kreis K., Durran D., Vahdat A., Pritchard M., Kautz J., "Demystifying Data-Driven Probabilistic Medium-Range Weather Forecasting," arXiv:2601.18111, (2026).

[35] Yao B., Luo D., Cao L., Kovachki N.B., O'Leary-Roseberry T., Ghattas O., "Derivative-Informed Fourier Neural Operator: Universal Approximation and Applications to PDE-Constrained Optimization," arXiv:2512.14086, (2025).

[36] de Hoop M.V., Kovachki N.B., Lassas M., Nelsen N.H., "Extension and neural operator approximation of the electrical impedance tomography inverse map," arXiv:2511.20361, (2025).

[37] Baptista R., Dasgupta A., Kovachki N.B., Oberai A., Stuart A.M., "Memorization and Regularization in Generative Diffusion Models," arXiv:2501.15785, (2025).

[38] Kovachki N.B., Lanthaler S., Mhaskar H., "Data Complexity Estimates for Operator Learning," arXiv:2405.15992, (2024).

[39] Li Z., Kovachki N.B., Azizzadenesheli K., Liu B., Bhattacharya K., Stuart A., Anandkumar A., "Neural Operator: Graph Kernel Network for Partial Differential Equations," arXiv:2003.03485, (2020).

SCHOOL LECTURES

- Mathematical Foundations of Deep Learning, Cambridge University. Aug 2026
  - Lectures on the approximation theory of Neural Operators.
- Prob AI Winter School, Warwick University. Jan 2026
  - Lectures on the approximation theory of Neural Operators.
- Summer School on "Machine learning for Solid Mechanics," CISM, Udine. Sep 2025
  - Lectures on Neural Operators for solid mechanics.

INVITED TALKS & PRESENTATIONS

Inverse Approximation for Electrical Impedance Tomography

- Mathematics of Physics-Oriented Machine Learning (MFO). *Talk*. Nov 2026

Data-Driven Weather Forecasting

- PhysML Workshop (Oslo). *Talk*. Jun 2026
- HACE - workshop on HPC/AI hybridization (Toulouse). *Talk*. May 2026
- Learning Models from Data for Multi-Fidelity Fusion Plasma Physics (IPAM). *Talk*. Apr 2026
- Bayesian Inverse Problems and UQ (ICERM). *Talk*. Mar 2026

Derivative-Informed Fourier Neural Operators

- IUTAM Symposium on Data Driven Mechanics (Cambridge). *Talk*. Apr 2025

Machine Learning for Scientific Computing

- IEEE CAI Workshop (Kyoto). *Talk*. Mar 2025
- Exploring System Dynamics in the Natural World with AI (Oslo). *Talk*. Oct 2024
- Packaging and Integration of Electronic and Photonic Microsystems (InterPACK). *Panelist*. Oct 2023

Generative Models on Function Space

- Diffusions in machine learning (Isac Newton Institute). *Talk*. Jul 2024
- PDE Methods in Machine Learning (BIRS). *Talk*. Jun 2024
- Biennial Meeting of SIAM Pacific Northwest Section (PNW). *Talk*. Oct 2023
- International Congress on Industrial and Applied Mathematics (ICIAM23). *Talk*. Aug 2023

Deep Learning on Function Spaces

- IC on Scientific Computation and Differential Equations (SciCADE). *Talk*. Jul 2022
- Deep Learning and Inverse Problems (INI MDLW02). *Talk*. Sep 2021
- Computation and Learning in High Dimensions (MFO). *Talk*. Aug 2021
- Foundations of Bayesian Inference for Complex Statistical Models (MFO). *Talk* (Virtual). May 2021
- SIAM Conference on Mathematics of Data Science (MDS20). *Talk* (Virtual). Jun 2020

Conditional Sampling via Measure Transport

- Second Symposium on Machine Learning and Dynamical Systems (Fields Institute). *Talk* (Virtual). Sep 2020
- SIAM Conference on Imaging Science (IS20). *Talk* (Virtual). Jul 2020

Understanding Momentum through Continuous Time Analysis

- International Congress on Industrial and Applied Mathematics (ICIAM19). *Talk*. Jul 2019
- Applied Inverse Problems (AIP). *Talks*. Jul 2019
- Inverse Problems and Machine Learning (IPML). *Talk*. May 2019
- SIAM Conference on Applications of Dynamical Systems (DS19). *Talk*. May 2019

Ensemble Kalman Inversion for Machine Learning

- International Congress on Industrial and Applied Mathematics (ICIAM19). *Talk*. Jul 2019
- Applied Inverse Problems (AIP). *Talks*. Jul 2019
- SIAM Conference on Computational Science and Engineering (CSE19). *Talk*. Feb 2019
- Southern California Applied Mathematics Symposium (SOCAMS). *Poster*. Apr 2018
- UQ for Inverse Problems in Complex Systems (INI UNQW04). *Poster*. Apr 2018
- Inverse Problems and Machine Learning (IPML). *Talk*. Feb 2018

ORGANIZING

- Applied Inverse Problems (AIP25) Jul 2025
  Minisymposium: *Probabilistic Learning Methods for Inverse Problems*
- SIAM Conference on Uncertainty Quantification (UQ22) Apr 2022
  Minisymposium: *Operator Learning in PDEs, Inverse Problems, and UQ*

PATENTS

- U.S. Patent 16/817,489: "Systems and Methods for Determining Molecular Structures with Molecular-Orbital-Based Features," *Filled* September 17, 2020.
- U.S. Patent 62/817,344: "Harvesting, Databasing, And Regressing Molecular-Orbital-Based Features For Accelerating Quantum Chemistry," *Filled* March 12, 2019.

SOFTWARE

- Neural Operator Library
  - https://github.com/neuraloperator/
- Torch Harmonics
  - https://github.com/NVIDIA/torch-harmonics/
- Earth-2 MIP
  - https://github.com/NVIDIA/earth2mip

REVIEWING

JOURNALS

- The Annals of Applied Probability 2025 – Present

- The SMAI journal of computational mathematics 2024 – Present
- AMS Mathematical Reviews 2024 – Present
- SIAM Journal on Uncertainty Quantification 2024 – Present
- SIAM Journal on Numerical Analysis 2023 – Present
- Foundations of Computational Mathematics 2022 – Present
- Journal of Machine Learning Research 2022 – Present
- Journal of Computational Physics 2021 – Present
- Quantum 2021 – Present
- Neural Networks 2021 – Present
- Inverse Problems 2020 – Present
- Constructive Approximation 2020 – Present
- SIAM Journal on Scientific Computing 2020 – Present

CONFERENCES

- Neural Information Processing Systems (NeurIPS) 2021 – Present
- International Conference on Machine Learning (ICML) 2021 – Present
- International Conference on Learning Representations (ICLR) 2020 – Present
- Mathematical and Scientific Machine Learning (MSML) 2020 – 2021

PROGRAMMING

- Python, C/C++, Julia, MATLAB, Mathematica

LANGUAGES

- English (fluent), Bulgarian (native), French (beginner)