

Luke Bhan

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RESEARCH	Physical AI, scientific machine learning, neural operators, learning-based control and optimization.	
EDUCATION	University of California, San Diego <i>Ph.D. Candidate, Electrical and Computer Engineering</i> Advisors: Yuanyuan Shi and Miroslav Krstic Expected graduation: June 2027	Sept. 2022–present
	Vanderbilt University, Nashville, Tennessee <i>M.S., Computer Science</i> Advisor: Gautam Biswas Thesis: <i>Deep Reinforcement Learning for Adaptive Control in Robotics</i>	Sept. 2020–May 2022
	Vanderbilt University, Nashville, Tennessee <i>B.S., Computer Science, Physics, and Applied Mathematics</i> Advisors: Gautam Biswas and Kálmán Varga	Sept. 2018–May 2020
GRANTS AND FELLOWSHIPS	<u>U.S. Department of Energy Computational Science Graduate Fellowship</u> Full funding for four years of Ph.D. One of approximately 30 fellows selected nationally each year across all STEM disciplines.	2023
	<u>NVIDIA Academic Grant</u> \$100,000 in support to continue building <u>PDE Control Gym: Physical AI Benchmarks for RL Control of PDE Systems</u> .	2026
HONORS AND AWARDS	Best Student Paper Award (<i>Distributed Parameter Systems at CDC</i>) Annual prize from the Technical Committee on Distributed Parameter Systems (TC DPS) for the best student-led paper: “Delay-Adaptive Control of Nonlinear Systems with Approximate Neural Operator Predictors” [C11].	2026
	Rising Star in Data Science (<i>University of Chicago</i>) Selected to present at the <u>Rising Stars in Data Science workshop</u> for early-career researchers.	2026
	Best Paper Award Finalist (<i>Learning for dynamics and control [L4DC]</i>) One of three finalists among 119 accepted papers at Learning for Dynamics and Control (L4DC), for “Neural Operators for Predictor Feedback Control of Nonlinear Delay Systems” [C10].	2025
	Commitment to Broadening Participation and Inclusivity in Engineering Award (<i>UC San Diego, ECE</i>) \$10,000 award recognizing a sustained commitment to broadening participation in engineering.	2022
	Underwood Memorial Award (<i>Vanderbilt University, Physics and Astronomy</i>) Awarded annually to the outstanding graduating senior in physics.	2020
	Best Undergraduate Paper Award (<i>Vanderbilt University, Physics and Astronomy</i>) Departmental prize for the strongest research paper by an undergraduate, for “Simulation of Photo-Electron Spectrum and Electron Scattering by Dual Time Propagation” [J1].	2020

INDUSTRY
INTERNSHIPS

Research Scientist Intern, Microsoft June 2026–Sept. 2026
Developed GridSFM, a foundation model for AC optimal power flow. This has since been turned into a startup: (asemic.ai) and additionally resulted in the journal paper [J15], submitted to IEEE Transactions on Power Systems.

Applied Scientist Intern, Amazon June 2025–Sept. 2025
Designed and fine-tuned LLMs to identify poor demand forecasts from time-series foundation models for 30+ million products autonomously. This work resulted in the paper “The Forecast Critic” [W1], published in a AAAI workshop and AMLC, the internal Amazon machine learning conference.

Research Intern, Lawrence Berkeley National Lab June 2024–Aug. 2024
Developed an adaptive, parallel, and inexact Newton method for nonlinear optimal control. This work led to the paper [J16], submitted to Automatica.

Software Engineering Intern, MongoDB June 2021–Aug. 2021
Developed the compression algorithm for MongoDB’s time-series database.

Machine Learning Intern, T-Mobile June 2020–Aug. 2020
Built an internal analytics API to visualize network loads and help prevent downtime.

JOURNAL
PUBLICATIONS

([†] denotes a student I mentored; [‡] denotes a submitted manuscript)

[J17][‡] [Luke Bhan](#), Miroslav Krstic, Yuanyuan Shi. “Rapid Fredholm stabilization of the Kuramoto–Sivashinsky equation with unrestricted, spatially-varying anti-diffusion.” Submitted to *ESAIM: Control, Optimisation and Calculus of Variations (COCV)*, 2026.

[J16][‡] [Luke Bhan](#), Michael W. Mahoney, Sen Na. “An Adaptive, Parallel, and Inexact Newton Method for Large-scale Nonlinear Optimal Control.” Submitted to *Automatica*, 2026. [arXiv:2609.33206](https://arxiv.org/abs/2609.33206).

[J15][‡] [Luke Bhan](#), Weiwei Yang, Margaret Capetz, Baosen Zhang. “GridSFM: A Foundation Model for Solving AC Optimal Power Flow.” Submitted to *IEEE Transactions on Power Systems*, 2026. [arXiv:2609.30173](https://arxiv.org/abs/2609.30173).

[J14][‡] Miroslav Krstic, [Luke Bhan](#). “Families of Control-Cost-Parametrized Inverse-Optimal Universal Stabilizers.” Submitted to *Systems & Control Letters*, 2026. [arXiv:2606.09047](https://arxiv.org/abs/2606.09047).

[J13][‡] Miroslav Krstic, Iasson Karafyllis, [Luke Bhan](#), Carina Veil. “Lotka–Sharpe Neural Operators for Control of Population PDEs.” Submitted to *IEEE Transactions on Automatic Control*, 2026. [arXiv:2604.03892](https://arxiv.org/abs/2604.03892).

[J12][‡] [Luke Bhan](#), Miroslav Krstic, Yuanyuan Shi. “Neural Operators for Predictor Feedback Control of Nonlinear Delay Systems.” Submitted to *IEEE Transactions on Automatic Control*, 2024. [arXiv:2411.18964](https://arxiv.org/abs/2411.18964).

[J11] [Luke Bhan](#), Miroslav Krstic, Yuanyuan Shi. “Predictor-Based Output-Feedback Control of Linear Systems with Time-Varying Input and Measurement Delays via Neural-Approximated Prediction Horizons.” *Systems & Control Letters*, vol. 218, 2026.

[J10] [Luke Bhan](#), Miroslav Krstic, Yuanyuan Shi. “Stabilization of Nonlinear Systems with Unknown Delays via Delay-Adaptive Neural Operator Approximate Predictors.” *Automatica, provisionally accepted*, 2026.

[J9] [Luke Bhan](#), Peter Quawas[†], Miroslav Krstic, Yuanyuan Shi. “Sampling-Horizon Neural Operator Predictors for Nonlinear Control Under Delayed Inputs.” *IEEE Control Systems Letters*, vol. 10, 2026.

- [J8] Maxence Lamarque, Luke Bhan, Yuanyuan Shi, Miroslav Krstic. “Adaptive Neural-Operator Backstepping Control of a Benchmark Hyperbolic PDE.” *Automatica*, vol. 177, 2025.
- [J7] Maxence Lamarque, Luke Bhan, Rafael Vazquez, Miroslav Krstic. “Gain Scheduling with a Neural Operator for a Transport PDE with Nonlinear Recirculation.” *IEEE Transactions on Automatic Control*, vol. 70, 2025.
- [J6] Luke Bhan, Yuanyuan Shi, Miroslav Krstic. “Adaptive Control of Reaction–Diffusion PDEs via Neural Operator-Approximated Gain Kernels.” *Systems & Control Letters*, vol. 195, 2025.
- [J5] Miroslav Krstic, Luke Bhan, Yuanyuan Shi. “Neural Operators of Backstepping Controller and Observer Gain Functions for Reaction–Diffusion PDEs.” *Automatica*, vol. 164, 2024.
- [J4] Luke Bhan, Yuanyuan Shi, Miroslav Krstic. “Neural Operators for Bypassing Gain and Control Computations in PDE Backstepping.” *IEEE Transactions on Automatic Control*, vol. 69, 2024.
- [J3] Luke Bhan, Cody L. Covington, Kálmán Varga. “Laser-Driven Petahertz Electron Ratchet Nanobubbles.” *Nano Letters*, vol. 22, 2022.
- [J2] Luke Bhan, Cody L. Covington, Kálmán Varga. “Signatures of Atomic Structure in Subfemtosecond Laser-Driven Electron Dynamics in Nanogaps.” *Physical Review B*, vol. 105, 2022.
- [J1] Luke Bhan, Cody L. Covington, Jason Rivas, Kálmán Varga. “Simulation of Photo-Electron Spectrum and Electron Scattering by Dual Time Propagation.” *The Journal of Chemical Physics*, vol. 154, 2021.

CONFERENCE PUBLICATIONS

(* denotes equal contribution; [†] denotes a student I mentored; [‡] denotes a submitted manuscript)

- [C17][‡] Luke Bhan, Miroslav Krstic, Yuanyuan Shi. “Fredholm Backstepping for the Kuramoto–Sivashinsky PDE with Nonconstant Antidiffusion and a Second Controllability-Ensuring Input—Part II: Neural Operator for Fredholm Gain.” Submitted to the *American Control Conference (ACC)*, 2026.
- [C16][‡] Luke Bhan, Miroslav Krstic, Yuanyuan Shi. “Fredholm Backstepping for the Kuramoto–Sivashinsky PDE with Nonconstant Antidiffusion and a Second Controllability-Ensuring Input—Part I: Design and Stability.” Submitted to the *American Control Conference (ACC)*, 2026.
- [C15] Luke Bhan, Miroslav Krstic, Yuanyuan Shi. “Neural-Approximated Time-Varying Prediction Horizons for Linear Predictor Feedback under Time-Varying Delays.” Accepted, *IEEE Conference on Decision and Control (CDC)*, 2026.
- [C14] Miroslav Krstic, Iasson Karafyllis, Luke Bhan, Carina Veil. “Lotka–Sharpe Neural Operators for Control of Population PDEs.” Accepted, *IEEE Conference on Decision and Control (CDC)*, 2026.
- [C13] Luke Bhan, Peter Quawas[†], Miroslav Krstic, Yuanyuan Shi. “Sampling-Horizon Neural Operator Predictors for Nonlinear Control under Delayed Inputs.” Accepted, *IEEE Conference on Decision and Control (CDC)*, 2026.
- [C12] Filip Bajraktari[†], Luke Bhan, Miroslav Krstic, Yuanyuan Shi. “Delay Compensation of Multi-Input Distinct Delay Nonlinear Systems via Neural Operators.” In Proceedings of the *American Control Conference (ACC)*, 2026.
- [C11] Luke Bhan, Miroslav Krstic, Yuanyuan Shi. “Delay-Adaptive Control of Nonlinear Systems with Approximate Neural Operator Predictors.” In Proceedings of the *IEEE Conference on Decision and Control (CDC)*, 2025. **IEEE TC DPS Best Student Paper Prize.**

[C10] [Luke Bhan](#)^{*}, Peijia Qin^{*†}, Miroslav Krstic, Yuanyuan Shi. “Neural Operators for Predictor Feedback Control of Nonlinear Delay Systems.” In Proceedings of the *Learning for Dynamics and Control Conference (L4DC)*, 2025. **Best Paper Award Finalist**.

[C9] Sharath Matada^{*}, [Luke Bhan](#)^{*}, Yuanyuan Shi, Nikolay Atanasov. “Generalizable Motion Planning via Operator Learning.” In Proceedings of the *International Conference on Learning Representations (ICLR)*, 2025.

[C8] [Luke Bhan](#)^{*}, Yuexin Bian^{*}, Miroslav Krstic, Yuanyuan Shi. “PDE Control Gym: A Benchmark for Data-Driven Boundary Control of Partial Differential Equations.” In Proceedings of the *Learning for Dynamics and Control Conference (L4DC)*, 2024.

[C7] [Luke Bhan](#), Yuanyuan Shi, Iasson Karafyllis, Miroslav Krstic, James B. Rawlings. “Moving-Horizon Estimators for Hyperbolic and Parabolic PDEs in 1-D.” In Proceedings of the *American Control Conference (ACC)*, 2024.

[C6] [Luke Bhan](#), Yuanyuan Shi, Miroslav Krstic. “Neural Operators for Hyperbolic PDE Backstepping Feedback Laws.” In Proceedings of the *IEEE Conference on Decision and Control (CDC)*, 2023.

[C5] [Luke Bhan](#), Yuanyuan Shi, Miroslav Krstic. “Neural Operators for Hyperbolic PDE Backstepping Kernels.” In Proceedings of the *IEEE Conference on Decision and Control (CDC)*, 2023.

[C4] [Luke Bhan](#), Yuanyuan Shi, Miroslav Krstic. “Operator Learning for Nonlinear Adaptive Control.” In Proceedings of the *Learning for Dynamics and Control Conference (L4DC)*, 2023.

[C3] [Luke Bhan](#), Marcos Quinones-Grueiro, Gautam Biswas. “Concurrent Policy Blending and System Identification for Generalized Assistive Control.” In Proceedings of the *IEEE Conference on Robotics and Automation (ICRA)*, 2022.

[C2] [Luke Bhan](#), Marcos Quinones-Grueiro, Gautam Biswas. “Fault Tolerant Control Combining Reinforcement Learning and Model-Based Control.” In Proceedings of the *International Conference on Control and Fault-Tolerant Systems (SysTol)*, 2021.

[C1] Adam Stager, [Luke Bhan](#), Andreas A. Malikopoulos, Liuhui Zhao. “A Scaled Smart City for Experimental Validation of Connected and Automated Vehicles.” In Proceedings of the *IFAC Symposium on Control in Transportation Systems (CTS)*, 2018.

WORKSHOP PAPERS

[W1] [Luke Bhan](#), Hanyu Zhang, Andrew Gordon Wilson, Michael W. Mahoney, Chuck Arvin. “The Forecast Critic: Leveraging Large Language Models for Poor Forecast Identification.” *AAAI AI4TS and AABA4ET Workshops*, 2026.

INVITED TALKS

SIAM Conference on Mathematics of Data Science (MDS26) Nov. 2026
Invited speaker, symposium on “Blending Data Assimilation and Control” (upcoming)

Seminar, University of Washington Mar. 2026
Hosted by Prof. Baosen Zhang

Fed-NeMO Seminar, Yale University Oct. 2024
Hosted by Prof. Lu Lu

Seminar, International Computer Science Institute, Berkeley June 2024
Hosted by Prof. Michael Mahoney

Seminar, Hong Kong University of Science and Technology
Hosted by Prof. Huan Yu

Mar. 2024

Control Seminar, University of California, San Diego
Hosted by Prof. Yang Zheng

Apr. 2023

RESEARCH
MENTORSHIP

I have been fortunate to mentor several talented students. Below is a brief overview of our work together. Students listed without a next step are still enrolled at UC San Diego.

Neal Jian (UC San Diego undergraduate) Current
Topic: Teleoperation design with multi-modal vision and sensing capabilities

Saravanan Valliappan (UC San Diego undergraduate) Current
Topic: Learning neural operator adapters for delay-aware control of robotic manipulators

Nathan Tatsuta (UC San Diego undergraduate) Current
Topic: Neural operator surrogates of computational fluid dynamic (CFD) models for hot-spot aware control of data centers for the [PDE Control Gym](#).

Peter Quawas (UC San Diego undergraduate) 2026
Topic: Neural operator predictors for control under sampled, delayed measurements [J9]

Filip Bajraktari (University of Belgrade undergraduate) 2025
Topic: Delay compensation of multi-input nonlinear systems via neural operators [C12]
Next step: M.S. student, ETH Zurich

Peijia Qin (Southern University of Science and Technology undergraduate) 2025
Topic: Neural operators for predictor feedback control of nonlinear delay systems [C10]
Next step: Ph.D. student, UC San Diego

Gabriel Bortoni (UC San Diego undergraduate) 2024
Topic: Neuron-model (Stefan) environment for the [PDE Control Gym](#)

Gokul Gandhikumar (UC San Diego M.S. student) 2024
Topic: ARZ traffic-flow environment for the [PDE Control Gym](#)

Evan Wu (UC San Diego undergraduate) 2024
Topic: Glioblastoma tumor-growth environment for the [PDE Control Gym](#)

Yunhao Li (UC San Diego undergraduate) 2023
Topic: Neural ODE dynamics and learning-based control
Next step: Ph.D. student, University of Wisconsin

TEACHING

Co-Instructor, *Machine Learning for Physical Applications* Spring 2025, 2026
University of California, San Diego

- Taught five lectures to 150+ students on scientific machine learning including foundation models, neural ODEs, neural operators, and physics-informed neural networks. Recorded and released publicly: [lecture videos](#) and [slides](#).
- Designed original homework assignments on augmented neural ODEs, Fourier neural operators, and physics-informed neural networks.

Teaching Assistant, *Numerical Analysis* Fall 2021
Vanderbilt University, Department of Mathematics

Teaching Assistant, *Introduction to Probability and Statistics*
Vanderbilt University, Department of Mathematics

Fall 2021

Teaching Assistant, *Intermediate Software Design*
Vanderbilt University, Department of Computer Science

Fall 2020–Fall 2021

ACADEMIC SERVICE

Workshop Co-Organizer

PDE-AI Workshop: AI for Modeling, Control, and Optimization of Partial Differential Equations,
American Control Conference (ACC), 2026.
acc-2026-ai-for-pde-workshop.vercel.app

Program Committee

AI Foundations for Power Grids Workshop, *Conference on Neural Information Processing Systems*
(NeurIPS), 2026.
ai4powergrids.github.io

Journal Reviewer

Automatica (2023–present)
IEEE Transactions on Automatic Control (2023–present)
Systems & Control Letters (2024–present)
International Journal of Robust and Nonlinear Control (2024–present)
IEEE Control Systems Letters (2025–present)
IEEE Transactions on Control of Networked Systems (2026–present)

Conference Reviewer

Learning for Dynamics and Control (L4DC) (2022–present)
AAAI Conference on Artificial Intelligence (AAAI) (2023–present)
IEEE Conference on Decision and Control (CDC) (2023–present)
International Conference on Learning Representations (ICLR) (2023–present)
American Control Conference (ACC) (2024–present)

REFERENCES

1. Yuanyuan Shi
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2. Miroslav Krstic
Distinguished Professor, Mechanical and Aerospace Engineering, UC San Diego
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3. Baosen Zhang
Associate Professor, Electrical and Computer Engineering, University of Washington
zhangbao@uw.edu
4. Nikolay Atanasov
Associate Professor, Electrical and Computer Engineering, UC San Diego
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