Lizuo Liu

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Employment

Dartmouth College, Hanover, NH — August, 2023 – Now

Postdoctoral Researcher

Postdoc mentors: Anne Gelb & Yoonsang Lee

Education

Southern Methodist University, Dallas, TX — January, 2019 – July, 2023

Ph.D. in Computational and Applied Mathematics

Thesis Title: Neural Network Learning for PDEs with Oscillatory Solutions and Causal Operators

Thesis adviser: Wei Cai

Southern Methodist University, Dallas, TX — May, 2020

M.S. in Computational and Applied Mathematics

Shanghai Jiao Tong University, Shanghai, China — September, 2014 – July, 2018

B.S. in Mathematics and Applied Mathematics

Research Interests

My research interests lie in applied and computational mathematics for artificial intelligence (AI), scientific machine learning, scientific computing, mathematics of machine learning and inverse problems. I develop advanced fast machine learning methods to understand complex physical phenomena and solve engineering problems (e.g. waves, fluid dynamics, combustion).

Publications

Journals

1. Bo Wang, Heng Yuan, Lizuo Liu, Wenzhong Zhang, and Wei Cai. On spectral bias reduction of multi-scale neural networks for regression problems. *Neural Networks*, 185:107179, 2025
2. Lizuo Liu and Wei Cai. Deeppropnet-a recursive deep neural network propagator for learning evolutionary pde operators. *Beijing Journal of Pure and Applied Mathematics*, 2(1):259–284, 2025
3. Lizuo Liu, Kamaljyoti Nath, and Wei Cai. A causality-deeponet for causal responses of linear dynamical systems. *Communications in Computational Physics*, 35(5):1194–1228, 2024
4. Lizuo Liu, Bo Wang, and Wei Cai. Linearized learning with multiscale deep neural networks for stationary navier-stokes equations with oscillatory solutions. *East Asian Journal on Applied Mathematics*, 13(3): 740–758, 2023
5. Wei Cai, Xiaoguang Li, and Lizuo Liu. A phase shift deep neural network for high frequency approximation and wave problems. *SIAM Journal on Scientific Computing*, 42:A3285–A3312, 2020

6. Junchao Gao, Franklin Li Duan, Chang Yu, Wentao Meng, Lizuo Liu, Guifu Ding, Congchun Zhang, and Ying Wang. Electrical insulation of ceramic thin film on metallic aero-engine blade for high temperature sensor applications. *Ceramics International*, 42(16):19269–19275, 2016

Magazine Articles & Editorials

7. Lizuo Liu and Wei Cai. Learning oscillatory Navier-Stokes flows and causal linear operators with deep neural network algorithms. *SIAM News*, June 2023. Online Article

Submitted

8. Lizuo Liu, Lu Zhang, and Anne Gelb. Parametric hyperbolic conservation laws: A unified framework for conservation, entropy stability, and hyperbolicity. *In preparation*, 2025
9. Lizuo Liu, Lu Zhang, and Anne Gelb. Neural entropy-stable conservative flux form neural networks for learning hyperbolic conservation laws, 2025, arXiv:2507.01795
10. Keenan Eikenberry, Lizuo Liu, and Yoonsang Lee. Invariant representations via wasserstein correlation maximization, 2025, arXiv:2505.11702
11. Bo Wang, Lizuo Liu, and Wei Cai. Multi-scale deeponet (mscale-deeponet) for mitigating spectral bias in learning high frequency operators of oscillatory functions, 2025, arXiv:2504.10932
12. Lizuo Liu, Tongtong Li, Anne Gelb, and Yoonsang Lee. Entropy stable conservative flux form neural networks, 2024, arXiv:2411.01746

Honors and Awards

- *SIAM Early Career Travel Award*, Award on SIAM Conference on Analysis of Partial Differential Equations, Pittsburgh, PA, November 17 – 20, 2025
- *Travel Grant*, Award on Mathematical Congress of the Americas, Miami, FL, July 21 – 25, 2025
- *Travel Fund*, Award on ICERM's workshop Computational Learning for Model Reduction, Providence, RI, January 6 – 10, 2025
- *Travel Fund*, Award on ICERM's workshop Mathematical and Scientific Machine Learning, Providence, RI, June 5 – 9, 2023
- *SIAM Student Travel Award*, Award on SIAM Conference on Mathematics of Data Science, San Diego, CA, September 26 – 30, 2022
- *2018 Excellent Bachelor Thesis*, Award on School of Mathematics Sciences, Shanghai Jiao Tong University

Teaching

Instructor, Math 13 Multi-variable Calculus, Department of Mathematics, Dartmouth College January – March, 2024, April – June, 2025

Teaching Assistant, Department of Mathematics, Southern Methodist University January, 2019 – May, 2020

Conference Organizations

High-Order Discretizations and Model Reduction in Nonlinear PDEs, 8th Annual Meeting of the SIAM Texas-Louisiana Section, Austin, TX September 26 – 28, 2025

Advances in PDE Operator Learning, Minisymposium Co-organizer of the SIAM Conference on Mathematics of Data Science, Atlanta, GA October 20 – 25, 2024

Highly Accurate Machine Learning Methods for Solving PDEs, Minisymposium Co-organizer of The third North American High Order Methods Conference, Dartmouth College, Hanover, NH June 17 – 19, 2024

Special session co-organizer at the AMS Spring Central Sectional Meeting, Purdue University, West Lafayette, IN March 26 – 27, 2022

Minisymposium Co-organizer of the 4th annual meeting of the SIAM Texas-Louisiana section, UTRGV, South Padre Island, TX November 5 – 7, 2021

Scientific Machine Learning Paper Reading Group, Department of Mathematics, Southern Methodist University March, 2020 – July, 2023

Presentations

1. *Parametric Hyperbolic Conservation Laws*, 25-minute minisymposium, 8th Annual Meeting of the SIAM Texas-Louisiana Section, Austin, TX, September 26 – 28, 2025
2. *Entropy Stable Conservative Flux Form Neural Networks*, 30-minute minisymposium, Mathematical Congress of the Americas 2025, Miami, FL, July 21 – 25, 2025
3. *Entropy Stable Conservative Flux Form Neural Nets*, 20-minute minisymposium, SIAM Conference on Computational Science and Engineering, Fort Worth, TX, March 3 – 7 , 2025
4. *DeepPropNet for Learning Non-homogeneous PDEs and Entropy-stable CFN for Hyperbolic Conservation Laws*, 20-minute minisymposium, SIAM Conference on Mathematics of Data Science, Atlanta, GA, October 20 – 25, 2024
5. *DeepPropNet - A Recursive Deep Neural Network Propagator for Learning Evolutionary PDE Operators*, 20-minute minisymposium, The third North American High Order Methods Conference, Hanover, NH, June 17 – 19, 2024
6. *Designing Neural Networks for Hyperbolic Conservation Laws to Predict Entropy Stable Solutions*, 20-minute minisymposium, SIAM New York-New Jersey-Pennsylvania Section, Newark, NJ, October 20 – 22, 2023
7. *Multiscale DNN for Oscillatory Navier-Stokes Flows and Causality in DNN for Dynamic Systems*, 30-minute minisymposium, SIAM Conference on Mathematics of Data Science, San Diego, CA, September 26 – 30, 2022
8. *Learning Causal Operators with DeepPropNet*, 30-minute minisymposium, SIAM Conference on Uncertainty Quantification, Atlanta, GA, April 12 – 15, 2022
9. *Multiscale DNN for Oscillatory Navier-Stokes Flows and Causality in DNN for Dynamic Systems*, 15-minute contributed talk, AMS Spring Central Sectional Meeting, Purdue University, West Lafayette, IN, March 26 – 27, 2022
10. *A Linearized Learning with Multiscale Deep Neural Network for Stationary Navier-Stokes Equations with Oscillatory Solutions*, 30-minute minisymposium, 4th Annual Meeting of the SIAM Texas-Louisiana Section, UTRGV, South Padre Island, TX, November 5 – 7, 2021
11. *Multiscale DNN for Stationary Navier Stokes Equations with Oscillatory Solutions*, 15-minute contributed talk, 16th U.S. National Congress on Computational Mechanics, Chicago, IL, July 25 – 29, 2021
12. *A Phase Shift Deep Neural Network For High Frequency Approximation And Wave Problems*, 30-minute minisymposium, 3rd Annual Meeting of the SIAM Texas-Louisiana Section, College Station, TX, October 16 – 18, 2020

Graduate Course List

- Perturbation Methods
- Finite Element Analysis
- Numerical Methods I&II
- Intro Dynamical Systems
- Dynamical Systems and Chaos
- Partial Differential Equations
- Fluid Dynamics
- Real and Functional Analysis
- Linear and Nonlinear Waves
- Applied Stochastic Differential Equations
- Computational Electromagnetics
- Parallel Scientific Computing

- Waves in Random Medium and Uncertainty Quantifications
- Stochastic computing and Monte Carlo Methods
- Quantum Mechanics

REFERENCES

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Reza Malek-Madani
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John David Trout
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