

# Qian Zhang

- 395 Angell St, Apt 104, Providence, RI, 02906
- Email: qian\_zhang1@brown.edu • Tel: +1 (203) 500-7964

## EDUCATION

### Ph.D. in Applied Mathematics

Aug 2021 – current

Division of Applied Mathematics, Brown University

- PhD Candidate. Advisor: Prof. George Em Karniadakis
- GPA: 4.0/4.0. Expected time of graduation: May 2026
- Research Interest: AI for Science, optimal control, neuromorphic computation for scientific machine learning

### Sc.M. in Applied Mathematics

Aug 2021 – Jun 2024

Division of Applied Mathematics, Brown University

- GPA: 4.0/4.0
- Selected Courses: applied probability and statistics, deep learning, theory of probability, numerical PDEs, PDEs

### B.S. in Theoretical and Applied Mechanics

Sep 2016 – Jul 2020

Department of Mechanics and Engineering Science, Peking University, China

- Excellent Undergraduate Thesis

## PROGRAMMING SKILLS

Python (JAX, PyTorch, TensorFlow, NumPy, SciPy, scikit-learn, pandas, Matplotlib), Julia, MATLAB, C/C++, R (tidyverse)

## RESEARCH EXPERIENCE (PHD)

### High-Dimensional Optimal Control with Transformers

Apr 2024 – current

- Develop and apply Transformer-based neural networks to solve optimal control problems utilizing Pontryagin's Maximum Principle.
- Capable of solving high-dimensional optimal path planning problems with robustness to perturbations in boundary conditions.

### Operator Learning for Reconstruction Problems

Oct 2023 – current

- Propose the operator learning framework for reconstruction problems.
- Implement Transformer-based neural networks for reconstructing flow fields from sparse measurements.
- Widely applicable to various reconstruction problems across diverse scientific and engineering disciplines.
- Design foundation models for reconstruction tasks leveraging large language models (LLMs).

### Neuromorphic Computation for Scientific Machine Learning

Apr 2022 – current

Collaborate with Yale University, Pacific Northwest National Laboratory (PNNL), and Sandia National Laboratories.

- Formulate regression tasks within the spiking neural network framework.
- Validate the stability of spiking neural networks for long-term simulations of dynamic systems.
- Prove convergence theorem guaranteeing scientific machine learning models can be converted to neuromorphic hardware with high accuracy and efficiency
- Design learning algorithms for neuromorphic platforms to optimize training efficiency.
- Lead a research team to initiate and drive follow-up studies within the research group.

## RESEARCH EXPERIENCE (UNDERGRAD)

### Numerical Boundary Treatment for Differential Equations

Sep 2018 – Aug 2021

- Design artificial boundary conditions for multi-scale simulation of atom chains.
- Propose a numerical boundary treatment for simulating shock propagation in the fractional KdV-Burgers equation.

## TEACHING EXPERIENCE

### Directed Reading Program, Mentor

Sep 2023 – Dec 2023

### APMA 1650 Statistical Inference I, Teaching Assistant

Feb 2023 – May 2024

### APMA 1210 Operations Research: Deterministic Models, Teaching Assistant

Sep 2022 – Dec 2022

## SELECTED HONORS & AWARDS

Award for Excellent Undergraduate Thesis, College of Engineering, Peking University 2020.06

Shuping Scholarship 2019.12, 2018.12, 2017.12

Award for Academic Excellents, Peking University 2018.12

10th National Undergraduate Mathematics Competition, Second Prize 2018.11

34th National (regional) Undergraduate Physics Competition, First Prize 2017.12

28th Beijing Mathematics Competition, Second Prize 2017.11

## PUBLICATIONS

Bradley H. Theilman, **Qian Zhang**, Adar Kahana, Eric C. Cyr, Nathaniel Trask, James B. Aimone, George Em Karniadakis. Spiking Physics-Informed Neural Networks on Loihi 2. 2024 Neuro Inspired Computational Elements Conference (NICE) (2024)

**Qian Zhang**, Chenxi Wu, Adar Kahana, Youngeun Kim, Yuhang Li, George Em Karniadakis, Priyadarshini Panda. Artificial to Spiking Neural Networks Conversion for Scientific Machine Learning. Under review for *SIAM Journal on Scientific Computing*.

**Qian Zhang\***, Adar Kahana\*, George Em Karniadakis, Panos Stinis. SMS: Spiking Marching Scheme for Efficient Long Time Integration of Differential Equations. *Journal of Computational Physics*, 516, 113363. Adar Kahana\*, **Qian Zhang\***, Leonard Gleyzer\*, George Em Karniadakis. Spiking Neural Operators for Scientific Machine Learning. Accepted by *Communications in Computational Physics*.

**Qian Zhang\***, Konstantina Sampani\*, Mengjia Xu, Shengze Cai, Yixiang Deng, He Li, Jennifer K. Sun, George Em Karniadakis. AOSLO-net: A Deep Learning-Based Method for Automatic Segmentation of Retinal Microaneurysms From Adaptive Optics Scanning Laser Ophthalmoscopy Images. *Translational Vision Science & Technology* 11(8):7 (2022)

Xinyi Guan, **Qian Zhang**, Shaoqiang Tang. Numerical boundary treatment for shock propagation in the fractional KdV-Burgers equation. *Computational Mechanics* 69, 201–212 (2022).

Baiyili Liu, **Qian Zhang**, Shaoqiang Tang. Stable heat jet approach for temperature control of Fermi-Pasta-Ulam beta chain, *Theoretical and Applied Mechanics Letters* 11(1):100226 (2021)

**Qian Zhang**, Dan Qiao, and Shaoqiang Tang, Designing Artificial Boundary Conditions for Atom Chains by Machine Learning, *Mechanics in Engineering* 42(1) (2020)

## LANGUAGES

Chinese (Native), English (Fluent)