

SHIHENG ZHANG

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RESEARCH SUMMARY

My research lies at the interface of optimization, deep learning, dynamical low-rank approximation, and scientific computing. I aim to design efficient and robust algorithms with theoretical guarantees, with applications to structure-preserving learning methods and large-scale numerical computation.

RESEARCH INTERESTS

Optimization, Deep Learning, Dynamical Low-Rank Approximation, Scientific Computing, Machine Learning

EDUCATION

Purdue University
West Lafayette, IN

09/2019 – 12/2023

- Ph.D. in Computational and Applied Mathematics
- Advisor: Prof. Jie Shen
- Thesis: Energy-Dissipative Methods in Numerical Analysis, Optimization and Deep Neural Networks for Gradient Flows and Wasserstein Gradient Flows

Southern University of Science and Technology
Shenzhen, China

09/2015 – 06/2019

- B.S. in Computational and Applied Mathematics
- Advisor: Prof. Jiang Yang, Prof. Bingsheng He

PROFESSIONAL EXPERIENCE

University of Washington, Department of Applied Mathematics
Seattle, WA

01/2024 – Present

- Postdoctoral Researcher (with Prof. Jingwei Hu)
- Scientific ML and numerical optimization; dynamical low-rank algorithms for kinetic equations and related PDEs

PUBLICATIONS

* denotes equal contribution or alphabetical ordering.

2025

1. **S. Zhang***, J. Zhang*, J. Shen, and G. Lin. A Relaxed Vector Auxiliary Variable Algorithm for Unconstrained Optimization Problems. *SIAM Journal on Scientific Computing*, 2025.
2. **S. Zhang** and J. Shen. Structure preserving schemes for a class of Wasserstein gradient flows. *Communications on Applied Mathematics and Computation*, 2025.
3. L. Einkemmer*, J. Hu*, and **S. Zhang***. Asymptotic-Preserving Dynamical Low-Rank Method for the Stiff Nonlinear Boltzmann Equation. *Journal of Computational Physics*, 2025.
4. **S. Zhang** and J. Hu. On the stability of the low-rank projector-splitting integrator for hyperbolic and parabolic equations. arXiv:2507.15192, 2025.

2024

1. **S. Zhang**, J. Shen, and J. Hu. SAV-based entropy-dissipative schemes for a class of kinetic equations. arXiv:2408.16105, 2024.
2. J. Zhang*, **S. Zhang***, J. Shen, and G. Lin. Energy-dissipative evolutionary deep operator neural networks. *Journal of Computational Physics*, 2024.

AWARDS AND HONORS

- **Boeing Research Award**, University of Washington, 2025
- **T.T. Moh Graduate Scholarship**, Purdue University, 2019
- **Summa Cum Laude Graduate**, Southern University of Science and Technology, 2019
- **First Prize, Chinese Mathematics Competitions (Guangdong)**, Chinese Mathematical Society, 2017

INVITED TALKS & POSTERS

Invited Minisymposium Talks

- Structure preserving schemes for a class of Wasserstein gradient flows. SIAM Annual Meeting, Spokane, WA, July 2024.
- A Relaxed Vector Auxiliary Variable Algorithm for Unconstrained Optimization Problems. SIAM Conference on Optimization, Seattle, WA, June 2023.

Posters

- SAV-based entropy-dissipative schemes for a class of kinetic equations. ICERM, Providence, RI, July 2025.
- Asymptotic-Preserving Dynamical Low-Rank Method for the Stiff Nonlinear Boltzmann Equation. CHaRM-NET Annual Meeting, Virginia Tech, VA, December 2024.
- SAV-based entropy-dissipative schemes for a class of kinetic equations. NSF Computational Mathematics PI Meeting, University of Washington, WA, July 2024.

TEACHING

Instructor (University of Washington)

- AMATH 351 A: Introduction to Differential Equations and Applications — Spring 2025
- AMATH 352 B: Applied Linear Algebra and Numerical Analysis — Winter 2025
- AMATH 351 A: Introduction to Differential Equations and Applications — Spring 2024

Teaching Assistant (Purdue University)

- MA 265: Linear Algebra; MA 266: Ordinary Differential Equations
- MA 261: Multivariate Calculus; MA 162: Calculus II; MA 161: Calculus I

TECHNICAL SKILLS

- **Programming:** Python (PyTorch, JAX, TensorFlow), Julia, C++, MATLAB, Git, SQL.
- **Expertise:** Numerical Optimization, Dynamical Low-Rank Methods, Scientific Machine Learning, Numerical Analysis for PDEs, Structure-Preserving Schemes.