# Suyi Gao (Stanley)

Ph.D. Student in Applied Mathematics · Purdue University

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## Research Interests

Scientific machine learning; operator learning and in-context learning for optimal control and mean-field control; generative models (diffusion models, normalizing flows) for inverse problems; optimal transport and Schrödinger bridges; Euclidean distance geometry.

## Education

**Purdue University** *Aug 2023 – present*
Ph.D. in Applied Mathematics · Advisor: Prof. Rongjie Lai *West Lafayette, IN*

**Rensselaer Polytechnic Institute** *Aug 2022 – Aug 2023*
Ph.D. program in Applied Mathematics (transferred to Purdue) *Troy, NY*

**McDaniel College** *Aug 2018 – May 2022*
B.A. in Mathematics and Physics (double major) · GPA 3.8/4.0 *Westminster, MD*

## Publications & Preprints

[1] **S. Gao**, M. Zhou, and R. Lai. "Self-supervised In-context Operator Learning for Stochastic Mean-Field Control." *arXiv preprint* arXiv:2608.18282, August 2026.

[2] S. D. Sikka, **S. Gao**, Z. Lu, R. Lai, and S. Mou. "Neural Operator Learning for Collision-Aware Trajectory Planning of Spacecraft Swarms." *arXiv preprint* arXiv:2608.00320, July 2026. Submitted to *Nature Machine Intelligence*.

## Research Experience

**Graduate Research Assistant** *Aug 2023 – present*
Department of Mathematics, Purdue University · Advisor: Prof. Rongjie Lai *West Lafayette, IN*

- **Self-supervised in-context operator learning for stochastic mean-field control** *(2025 – 2026)*. Training a transformer to solve whole families of control problems for large populations of interacting agents in a single pass, with no precomputed solutions needed [1].
- **Neural operator learning for spacecraft-swarm trajectory planning** *(2025 – 2026)*. Learning a network that plans fuel-efficient, collision-free maneuvers for an entire swarm of spacecraft at once; trained on 10 spacecraft, it scales to swarms of 1,000 [2].
- **Diffusion models for geometry problems** *(May 2024 – present)*. Combining diffusion models with classical optimization to recover point configurations from incomplete or noisy data.

**Undergraduate Researcher** *Summers 2019, 2020, 2021*
Department of Mathematics, McDaniel College *Westminster, MD*

- **Analysis on the Fibonacci word fractals.** Studied how the Laplacian operator behaves on a self-similar fractal generated by a word string and a turning rule, building approximating structures to compute its harmonic functions and spectral dimension.

## Presentations

**Minisymposium talk: "Self-supervised In-context Operator Learning for Stochastic Mean-Field Control"** — *Sep 19–20, 2026*
SIAM Great Lakes Section Annual Meeting, Purdue University — *West Lafayette, IN*

**Poster: "Laplacian on the 2-nacci Fractal at the Critical Angle"** — *Jan 2022*
Joint Mathematics Meetings (JMM) — *Virtual*

**Talk: "A Projective Limit Construction of the 2-nacci Fractal"** — *Aug 2019*
MAA MathFest — *Cincinnati, OH*

## Teaching Experience

**Teaching Assistant, Purdue University** — *Fall 2023, Fall 2026*
MA 261 Multivariate Calculus (Fall 2026); MA 162 Calculus II (Fall 2023) — *West Lafayette, IN*

**Teaching Assistant, Rensselaer Polytechnic Institute** — *Fall 2022 – Summer 2023*
MATH 1010 Calculus I (Fall 2022); MATH 4100 Multivariable Calculus & Linear Algebra (Summer 2023) — *Troy, NY*

**Mathematics & Physics Tutor, STEM Center, McDaniel College** — *2018 – 2021*
Calculus II, College Algebra & Trigonometry, Differential Equations, introductory physics, and Chinese — *Westminster, MD*

## Skills

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|---|---|
| **Programming** | Python (PyTorch, NumPy, SciPy), MATLAB, Mathematica, Java, LaTeX |
| **Methods** | Neural operators & transformers, diffusion models & normalizing flows, optimal transport, numerical methods for PDEs, optimization |
| **Languages** | Chinese (native), English (fluent) |

## Selected Graduate Coursework

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| **Purdue** | Introduction to Stochastic Calculus; Real Analysis II; Geometry & Learning for Manifold-structured Data; ODEs & Dynamical Systems; Numerical Methods for PDEs; Differential Geometry & Topology |
| **RPI** | Computational Optimal Transport; Machine Learning & Optimization; Introduction to Optimization; Computational Linear Algebra |

## Leadership & Service

**Mathematics Graduate Student Representative, Purdue University** — *Aug 2026 – present*

**SIAM Student Chapter, Purdue University** — *Aug 2024 – present*
Vice President (Aug 2026 – present); Secretary (Aug 2024 – Aug 2026)

**Kappa Mu Epsilon (KME) Mathematics Honor Society, McDaniel College** — *2020 – 2022*
President (2021 – 2022); Historian (2020 – 2021)

**Vice President, Society of Physics Students (SPS), McDaniel College** — *2020 – 2022*