

Joanna Zou

[Website](#) | [Google Scholar](#) | [LinkedIn](#) | [Github](#)

Email: jjzou@mit.edu

Interests Applied statistics, probability, and machine learning, stochastic differential equations, dynamical systems, measure transport, Bayesian inference, Kalman filtering, uncertainty quantification, active learning, risk analysis, signal processing, computational science and engineering.

Education **Massachusetts Institute of Technology** Cambridge, MA
PhD in Computational Science & Engineering Feb. 2022 – May 2026
• Advisor: Youssef Marzouk
• Thesis: *Goal-Oriented Learning of Stochastic Dynamical Systems*

Stanford University Stanford, CA
MS in Structural Engineering Sep. 2018 – May 2020
• Advisor: Gregory Deierlein
• Stanford Engineering Graduate Fellowship recipient

Columbia University New York, NY
BS in Civil Engineering Aug. 2014 – May 2018
• GPA: 3.95 / 4.00 (*magna cum laude*)
• Top graduate in civil engineering (out of 32)

Honors and scholarships SFB 1294 Data Assimilation PhD Research Fellowship 2024
JuliaCon Young Researchers Grant 2022
CECAM Workshop Best Poster Award 2022
Fulbright U.S. Student Scholarship 2020
Stanford Engineering Graduate Fellowship 2018
Thornton-Tomasetti Foundation Scholarship 2018
ASCE Arthur Tuttle Fellowship 2018
Columbia George Wendell Memorial Award 2018
Columbia Robert Ridgway Award 2018
ACEC New York Merit Scholarship 2017
Columbia University Henry Michel Scholarship 2015

Research appointments **Massachusetts Institute of Technology** Cambridge, MA
Postdoctoral Associate Jun. 2026 - Present
Methodological work:
• Improve efficiency of optimization solutions to stochastic optimal control problems via dimension reduction of the control space

Graduate Research Assistant

Feb. 2022 - May 2026

Methodological work:

- Develop theory for spectral reduction of SDEs in infinite dimensions
- Derive goal-oriented loss to control error in transition properties of diffusions
- Accelerate ML training using a greedy kernelized active learning algorithm
- Curate efficient training sets using DPPs for diversity-based subsampling

Experience:

- Develop custom Julia packages for Bayesian inference of ML force fields
- Construct HPC workflows for NN training and Monte Carlo simulations
- Coordinate weekly journal club for reviewing papers
- Tutor students in courses on probability and statistics

University of Potsdam

Potsdam, Germany

Visiting PhD Research Fellow in Mathematics

Jun. 2024 - Aug. 2024

Methodological work:

- Define variational learning objectives for improved sample efficiency and fidelity of pathwise properties of SDEs
- Derive and implement an exact computable loss gradient for optimization

Sandia National Laboratories

Livermore, CA

Graduate Research Intern

Jun. 2023 - Aug. 2023

Methodological work:

- Reduce cost of uncertainty quantification of diffusion processes using an adaptive importance sampling-based control variate framework
- Validate method on experiments with LAMMPS molecular simulation

Technical University of Delft

Delft, Netherlands

Fulbright Research Fellow

Jan. 2021 - Dec. 2021

Methodological work:

- Develop latent variable model to predict strain-induced damage in offshore wind turbines using sparse acceleration data and Bayesian filtering
- Select validation data from 2-year vibration dataset using signal processing

NHERI-SimCenter

Berkeley, CA

Software Development & Research Associate

Aug. 2020 - Dec. 2020

Experience:

- Write Python code to develop natural hazards simulation software utilizing modern ML and UQ workflows
- Construct parallel computing workflow for multiscale earthquake simulation

Stanford University

Stanford, CA

Graduate Research Assistant

Sep. 2018 - May 2020

Methodological work:

- Accelerate probabilistic risk analysis by developing heteroscedastic GP surrogate models of the seismic response of buildings
- Generate data via numerical dynamic simulations using seismic recordings
- Train and tune a U-Net CNN for land use classification from satellite imagery

Experience:

- Create and deliver a 2-part lecture on convex optimization for graduate course
- Tutor for Bachelor/Master courses in math, statistics, computer science

Arup

Advanced Technology & Research Intern

San Francisco, CA

Jun. 2018 - Aug. 2018

Experience:

- Quantify seismic risk of building portfolio using probabilistic risk analysis
- Develop finite element models for soil-structure interaction analysis

Publications

Preprints

[P7] J. Zou, F. Birks, D. Foster, Y. Marzouk. “Stein kernelized molecular dynamics for active learning of interatomic potentials.” *arXiv preprint arXiv:2606.04100*. 2026.

[P6] J. Zou, H. C. Lie, Y. Marzouk. “Goal-oriented learning of stochastic differential equations using error bounds on path-space observables.” *arXiv preprint arXiv:2063.20467*. 2026.

Journal articles

[J5] J. Zou, E. Lourens, A. Cicirello. “Virtual sensing of subsoil strain response in monopile-based offshore wind turbines via Gaussian process latent force models.” *Mechanical Systems & Signal Processing*. 200, 110488. 2023.

Peer-reviewed conference proceedings

[C4] J. Zou, Y. Marzouk. “Data curation for machine learning interatomic potentials by determinantal point processes.” *ICLR AI for Accelerated Materials Design Workshop*. 2025.

[C3] J. Zou, A. Cicirello, A. Iliopoulos, E. Lourens. “Gaussian process latent force models for virtual sensing in a monopile-based offshore wind turbine.” *Proceedings of the European Workshop on Structural Health Monitoring*, pp. 290-298. 2022.

[C2] J. Zou, D. Welch, A. Zsarnoczay, A. Taflanidis, G. Deierlein. “Surrogate modeling for the seismic response estimation of residential wood frame structures.” *Proceedings of the 17th World Conference in Earthquake Engineering*. 2020.

[C1] Y. Dong, **J. Zou**, J. Liu, J. Fagert, M. Mirshekari, L. Lowes, M. Iammarino, P. Zhang, H. Noh. “Physics-informed analysis of patient induced structural vibration data for early muscular dystrophy detection.” *Third Workshop on Combining Physical and Data-Driven Knowledge in Ubiquitous Computing (UbiComp-CPD)*, pg. 525-531. 2020.

**Talks and
presentations**

Invited talks

[T13] “Dimension reduction on Hilbert spaces of drift functions of stochastic differential equations.” *SIAM Conference on Uncertainty Quantification (SIAM UQ)*, Minneapolis, MN. March 2026.

[T12] “Goal-oriented learning of stochastic dynamical systems using error bounds on path-space observables.” *SIAM Conference on Applied Dynamical Systems (SIAM DS)*, Denver, CO. May 2025.

[T11] “Path-space error bounds for the statistical learning of stochastic differential equations.” *University of Potsdam SIAM Chapter Seminar*, Potsdam, Germany. August 2024.

[T10] “Cairn.jl: Enhanced Molecular Dynamics for Active Learning.” *JuliaCon*, Eindhoven, Netherlands. July 2024.

[T9] “Active learning of energy-based models via stochastic Stein variational gradient descent.” *SIAM Conference on Uncertainty Quantification (SIAM UQ)*, Trieste, Italy. February 2024.

[T8] “Adaptive importance sampling for gradient-based dimension reduction in stochastic systems.” *International Conference on Uncertainty Quantification in Computational Science and Engineering (UNCECOMP)*, Athens, Greece. June 2023.

[T7] “Gaussian process latent force models for virtual sensing of offshore wind turbines.” *European Workshop on Structural Health Monitoring (EWSHM)*, Sicily, Italy. June 2022.

Poster presentations

[P6] “Goal-oriented learning and uncertainty quantification of stochastic differential equations.” *MIT Center for the Exascale Simulation of Coupled High Enthalpy Fluid-Structure Interactions (CHEFSI)*, Cambridge, MA. April 2026.

[P5] “A goal-oriented loss for learning transition times with machine learning potentials.” *ICMS Workshop on Computational Materials Science and Mathematics at the Particle and Atomistic Scales*, Edinburgh, UK. November 2025.

[P4] “Data curation for machine learning interatomic potentials by determinantal point processes.” *ICLR AI for Accelerated Materials Design Workshop*, Singapore. April 2025.

[P3] “Using error bounds on molecular properties for goal-oriented learning of machine learning potentials.” *MIT Center for the Exascale Simulation of Material Interfaces in Extreme Environments (CESMIX)*, Cambridge, MA. April 2025.

[P2] “Active subspaces for Bayesian inference of machine learning interatomic potential models.” *MIT Center for the Exascale Simulation of Material Interfaces in Extreme Environments (CESMIX)*, Cambridge, MA. Oct. 2023.

[P1] “Bayesian modeling and active learning for molecular dynamics: fitting machine learning interatomic potentials to data.” *EPFL CECAM Workshop on Error Control in First Principles Modeling*, Lausanne, Switzerland. June 2022.

Academic service

Minisymposium organization

SIAM Conference on Uncertainty Quantification (SIAM UQ)

“Advances in MCMC Sampling Methods” 2026

“UQ for Multiscale Modeling in Computational Chemistry” 2026

SIAM Conference on Applied Dynamical Systems (SIAM DS)

“Learning with Dynamical Systems and Their Observable Statistics” 2025

Peer reviews

International Journal of Uncertainty Quantification (IJUQ)

Mechanical Systems and Signal Processing (MSSP)

Data-Centric Engineering (DCE) Journal

Student organizations

MIT Assoc. of Computational Engineering and Science Students (ACSES)

Vice President 2023-2025

- Increased engagement and seminar participation among CSE students
- Represented CSE student interests in institute-wide affairs

MIT European Club

Outreach Chair 2024-2025

- Lead outreach efforts to recruit universities, research institutions, and companies to participate in the MIT European Career Fair
- Organized company info sessions and professional development workshops

MIT Graduate Student Council, External Affairs Committee

Graduate Student Advocate 2025

- Advocated for graduate education and federal research funding through meetings with congressional offices in Washington D.C.

Columbia American Society of Civil Engineers (ASCE)

President

2017-2018

- Initiated mentorship program among undergraduate engineering students
- Lead the coordination of a career panel featuring professionals and academics
- Organized student career development workshops with professional societies
- Increased student-faculty engagement through social events
- Coordinated site visits of active development projects in New York City
- Arranged student volunteer groups with Habitat for Humanity

**Teaching
& mentoring**

MIT AeroAstro Graduate Admissions Assistance Program

Mentor

2022-2025

- Provided 1-on-1 guidance on PhD applications for prospective students

Stanford Academic Resources Center

Course Tutor and Pre-College Student Mentor

2020

- Advised, mentored, and supervised high school students in the Stanford Pre-Collegiate Summer Institute
- Designed and delivered an online workshop and exercises on "Effective Data Visualization: How to Design Figures in Python"
- Provided tutoring for students in math, statistics, physics, and computer science courses

Stanford CEE 280: Advanced Structural Analysis

Guest Lecturer

2019

- Designed and delivered a 2-part lecture and homework assignment on numerical optimization methods to a 40-student course

Columbia University Office of Residential Programs

Resident Advisor

2015-2018

- Advised, mediated, and supervised 50-70 students per year in undergraduate residences, providing support on student wellness and mental health, academic performance, and diversity, equity, and inclusion.