

# BENJAMIN JIAHONG ZHANG

---

## CURRENT POSITION & CONTACT

Postdoctoral Research Associate, Department of Mathematics and Statistics

Lederle Graduate Research Tower  
Room 1422B  
University of Massachusetts  
710 N. Pleasant Street  
Amherst, MA 01003

Email: [bjzhang@umass.edu](mailto:bjzhang@umass.edu)  
Website: [benjzhang.github.io](https://benjzhang.github.io)

## EDUCATION

**Massachusetts Institute of Technology**, Cambridge, MA 02/2022

*PhD, Computational Science and Engineering*

- Thesis: *Efficient sampling methods of, by, and for stochastic dynamical systems*
- Committee: Youssef Marzouk, Tuhin Sahai, Themistoklis Sapsis, Konstantinos Spiliopoulos

**SM, Aeronautics and Astronautics** 06/2017

- Thesis: *A Coupling Approach to Rare Event Simulation via Dynamic Importance Sampling*
- Advisor: Youssef Marzouk

**University of California, Berkeley**, Berkeley, CA 05/2015

*BS, Engineering Physics*

*BA, Applied Mathematics*, Concentration in Numerical Analysis

- Graduated Highest Honors in Applied Mathematics, Distinction in General Scholarship
- Thesis: *A Computational Study of Seizure Attenuation via Anderson Localization*
- Advisors: Mohammad-Reza Alam and Per-Olof Persson

## RESEARCH INTERESTS

Rare event simulation, Monte Carlo methods, Data-driven methods for dynamical systems, Stochastic differential equations, Bayesian computation

## RESEARCH EXPERIENCE

**Department of Mathematics & Statistics, UMass Amherst** Amherst, MA

*Postdoctoral Research Associate* 09/2022 - Present

Advisors: Markos Katsoulakis, Luc Rey-Bellet, Paul Dupuis (Brown University)

**Department of Aeronautics and Astronautics, MIT** Cambridge, MA

*Postdoctoral associate* 01/2022 - 08/2022

*Research assistant* 09/2015 - 01/2022

Supervised by Professor Youssef Marzouk in the Uncertainty Quantification group.

**Department of Mechanical Engineering, UC Berkeley** Berkeley, CA

*Undergraduate research assistant* 09/2013 - 08/2015

Supervised by Professor Reza Alam. Studied noninvasive seizure attenuation methods via Anderson localization.

## TEACHING EXPERIENCE

**Department of Aeronautics and Astronautics, MIT** Cambridge, MA

*Course developer* 12/2019 - 04/2020

Designed and co-wrote curriculum for MIT xPro online course on Modeling, Simulation, and Machine learning for working professionals.

*Teaching assistant* 01/2019 - 05/2019

Undergraduate probability & statistics for aerospace engineering. Awarded best teaching assistant award by the students.

*Course developer and co-instructor* Spring 2018, 2019

Designed curriculum and co-taught course for 16.S685 "A hands-on introduction to computational engineering," an introductory course targeted at first and second year undergraduates.

**Seminar XL instructor** 09/2018 - 05/2019  
 Lead small 18.03 (Differential Equations) study groups for first year URM students. Facilitated by the MIT Office of Minority education.

**Teaching assistant and grader** 09/2018 - 12/2018  
 Graduate class on numerical methods for stochastic processes and inference. Also served as informal teaching assistant and held office hours.

**Subject Design Certificate Program** 07/2020  
 From the MIT Teaching and Learning lab.

**Department of Mathematics, UC Berkeley** Berkeley, CA  
**Teaching assistant** 01/2015 - 05/2015  
 Second semester introductory calculus.

PROFESSIONAL EXPERIENCE

**United Technologies Research Center, UTC** Berkeley, CA  
**Applied Mathematics Intern** 06/2017 - 09/2017  
 Researched queuing systems for modeling human operators. Also investigated using quantum computing for optimization.

PUBLICATIONS

7. **B. Zhang**, K. Spiliopoulos, and Y. Marzouk. Transport maps induce Riemannian manifold Langevin dynamics. In preparation.
6. **B. Zhang**, T. Sahai, and Y. Marzouk. Sampling via controlled stochastic dynamical systems. In preparation.
5. **B. Zhang**, T. Sahai, and Y. Marzouk. Computing eigenfunctions of the multidimensional Ornstein-Uhlenbeck operator. *arXiv preprint arXiv:2110.09229*, 2021
4. **B. Zhang**, Y. Marzouk, and K. Spiliopoulos. Geometry-informed irreversible perturbations for accelerated convergence of Langevin dynamics. *Statistics and Computing*, Accepted, 2022
3. **B. Zhang**, T. Sahai, and Y. Marzouk. A Koopman framework for rare event simulation in stochastic differential equations. *Journal of Computational Physics*, 2022
2. **B. Zhang**, Y. Marzouk, B.-Y. Min, and T. Sahai. Rare event simulation of a rotorcraft system. In *2018 AIAA Non-Deterministic Approaches Conference*, 2018
1. **B. Zhang**, M. Chamanzar, and M.-R. Alam. Suppression of epileptic seizures via Anderson localization. *Journal of The Royal Society Interface*, 2017

MENTORING

Master's theses advised:

- Joshua W. 2021-2022  
 Thesis: Rare event simulation via tensor-based approaches to stochastic optimal control

Undergraduate research students advised:

- Joshua W. (MIT UROP, SuperUROP) 2019 - 2021
- Karolina P. (MIT UROP) 2018 - 2019

HONORS

Mathworks Engineering Fellowship 2019  
 AIAA Aeronautics & Astronautics Teaching Assistantship Award 2019  
 NSF Graduate Research Fellowships Program Honorable Mention 2015, 2016  
 Phi Beta Kappa 2015  
 Summer Undergraduate Research Fellowship (SURF L&S) 2014  
 Tau Beta Pi Engineering Honor Society 2013  
 Matsui Center Cal-in-Sacramento Fellowship 2013

SERVICE	Journal referee for <i>Probabilistic Engineering Mechanics</i>	2022
	Journal referee for <i>Stochastics and Partial Differential Equations</i>	2022
	Journal referee for <i>SIAM Journal on Scientific Computing (SISC)</i>	2021
	Journal referee for <i>Physica D: Nonlinear Phenomena</i>	2020
	SIAM UQ 2022 Minisymposium organizer	2022
	Title: <i>Data-Driven Approaches to Rare and Extreme Events</i> (8 talks)	
	SIAM CSE 2021 Minisymposium organizer	2021
	Title: <i>Computational Dynamics meets Computational Statistics</i> (10 talks)	
	SIAM CSE 2019 Minisymposium organizer	2019
	Title: <i>Advances in Rare Event Simulation for Complex Dynamical Systems</i> (8 talks)	
	Organizer of the Uncertainty Quantification Reading Group	2019 - 2021
	ACDL Undergraduate Research Opportunity Coordinator (UROP)	2017 - 2021
	Association of Computational Science and Engineering Students Co-President	2017 - 2018
	<ul style="list-style-type: none"> <li>Organized the 2018 and 2019 MIT Center for Computational Engineering annual symposium</li> </ul>	

INVITED TALKS &  
SEMINARS

5. **B. Zhang**, K. Spiliopoulos, and Y. Marzouk. The transport map unadjusted Langevin algorithm. Aerospace Computational Design Laboratory Seminar, Cambridge MA, April 1, 2022.
4. **B. Zhang**, T. Sahai, and Y. Marzouk. A Koopman framework for sampling in stochastic dynamical systems. LIDS and Stats Tea Talk, Cambridge, MA, April 8, 2020.
3. **B. Zhang**, T. Sahai, and Y. Marzouk. A Koopman framework for sampling in stochastic dynamical systems. Aerospace Computational Design Laboratory Seminar, Cambridge MA, December 6, 2019.
2. **B. Zhang**, T. Sahai, and Y. Marzouk. Sampling methods for stochastic dynamical systems using Koopman eigenfunctions. United Technologies Research Center, Berkeley, CA, September 25, 2019.
1. N. Chandramoorthy, and **B. Zhang**. Koopman operators and the problems related to their computation. Aerospace Computational Design Laboratory Seminar, Cambridge MA, December 7, 2018.

CONFERENCE &  
WORKSHOP  
PRESENTATIONS

16. **B. Zhang**, K. Spiliopoulos, and Y. Marzouk. Transport map unadjusted langevin algorithm: analysis and connections, 2022. SIAM Conference on Mathematics of Data Science, San Diego, CA.
15. **B. Zhang**, Q. Long, J. White, T. Sahai, and Y. Marzouk. Data-driven rare event simulation for stochastic dynamical systems: A Koopman operator approach, 2022. SIAM Conference on Uncertainty Quantification, Atlanta, GA.
14. **B. Zhang**, T. Sahai, and Y. Marzouk. Sampling via controlled stochastic dynamical systems (poster), 2021. I Can't Believe It's Not Better Workshop, Neural Information Processing Systems Conference.
13. **B. Zhang**, J. White, T. Sahai, and Y. Marzouk. Rare event simulation for linear SDEs via multilevel splitting, 2021. SIAM Conference on Applications of Dynamical Systems, Portland, OR.
12. **B. Zhang**, T. Sahai, and Y. Marzouk. Sampling via controlled stochastic dynamical systems, 2021. SIAM Conference on Computational Science and Engineering, Austin, TX.
11. **B. Zhang**, T. Sahai, and Y. Marzouk. Sampling via controlled stochastic dynamical systems, 2020. Second symposium on machine learning and dynamical systems, Fields Institute.
10. **B. Zhang**, T. Sahai, and Y. Marzouk. Importance sampling for linear SDEs using eigenfunctions of the Ornstein-Uhlenbeck operator (poster), 2019. ICERM workshop on Mathematical Optimization of Systems Impacted by Rare, High-Impact Random Events, Providence, RI. (**Travel grant awarded**)

9. **B. Zhang**, T. Sahai, and Y. Marzouk. Rare event simulation in nonlinear dynamical systems via the Koopman operator, 2019. International Congress on Industrial and Applied Mathematics, Valencia, Spain.
8. **B. Zhang**, T. Sahai, and Y. Marzouk. Towards a generalized theory of rare event simulation for linear stochastic differential equations, 2019. SIAM Conference on Applications of Dynamical Systems, Snowbird, UT.
7. Q. Long, **B. Zhang**, Y. Marzouk, A. Gorodetsky, and T. Sahai. Tensor decomposition-based splitting methods for rare event simulation, 2019. SIAM Conference on Applications of Dynamical Systems, Snowbird, UT.
6. **B. Zhang**, T. Sahai, and Y. Marzouk. Efficient simulation of rare events in stochastic differential equations, 2019. SIAM Conference on Computational Science and Engineering, Spokane, WA.
5. **B. Zhang**, T. Sahai, and Y. Marzouk. Rare event simulation for dynamical systems in the presence of an attractor, 2018. SIAM Annual Meeting, Portland, OR.
4. **B. Zhang** and T. Sahai. A probabilistic analysis and rare event study of a dynamical queue for modeling human operators, 2018. SIAM Conference on Uncertainty Quantification, Garden Grove, CA.
3. **B. Zhang**, Y. Marzouk, B.-Y. Min, and T. Sahai. Rare event simulation of a rotorcraft system, 2018. AIAA Scitech Forum Non-deterministic Approaches Conference, Kissimmee, FL.
2. **B. Zhang**, Y. Marzouk, B.-Y. Min, and T. Sahai. Rare event simulation via dynamic importance sampling and measure transport (poster), 2017. USACM Thematic Workshop on Uncertainty Quantification and Data-Driven Modeling, Austin, TX. (**Travel grant awarded**)
1. **B. Zhang**, Y. Marzouk, and T. Sahai. Scalable methods for rare event simulation in rotorcraft systems, 2017. SIAM Conference on Computational Science and Engineering, Atlanta, GA.

WORKSHOPS  
ATTENDED

7. Data Assimilation – Mathematical Foundation and Applications, Mathematisches Forschungsinstitut Oberwolfach (MFO, Oberwolfach Research Institute for Mathematics) , February 20-26, 2022.
6. “I Can’t Believe It’s Not Better” Workshop at the Neural Information Processing Systems Conference (NeurIPS) 2021, held virtually, December 13, 2021.
5. Second Symposium on Machine Learning and Dynamical Systems, Fields Institute for Research in Mathematical Sciences, University of Toronto, September 21-29, 2020.
4. Mathematical Optimization of Systems Impacted by Rare, High-Impact, Random Events, Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University, June 24-28, 2019.
3. Optimal Transport: Numerical Methods and Applications, Lake Como School of Advanced Studies, May 7-11, 2018.
2. USACM Workshop on Uncertainty Quantification and Data-Driven Modeling, Austin TX, March 23-24, 2017.
1. Summer School in Monte Carlo Methods for Rare Events, Division of Applied Mathematics, Brown University, June 13-17, 2016.