

# BENJAMIN JIAHONG ZHANG

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CURRENT POSITION	Postdoctoral Research Associate, Department of Mathematics and Statistics, University of Massachusetts Amherst	
CONTACT INFORMATION	Lederle Graduate Research Tower Room 1422B University of Massachusetts 710 N. Pleasant Street Amherst, MA 01003	Email: <a href="mailto:bjzhang@umass.edu">bjzhang@umass.edu</a> Website: <a href="https://benjzhang.github.io">benjzhang.github.io</a>
EDUCATION	<b>Massachusetts Institute of Technology</b> , Cambridge, MA	02/2022
	<i>PhD, Computational Science and Engineering</i> <ul style="list-style-type: none"><li>• Thesis: <i>Efficient sampling methods of, by, and for stochastic dynamical systems</i></li><li>• Committee: Youssef Marzouk, Tuhin Sahai, Themistoklis Sapsis, Konstantinos Spiliopoulos</li></ul>	
	<b>SM, Aeronautics and Astronautics</b>	06/2017
	<ul style="list-style-type: none"><li>• Thesis: <i>A Coupling Approach to Rare Event Simulation via Dynamic Importance Sampling</i></li><li>• Advisor: Youssef Marzouk</li></ul>	
	<b>University of California, Berkeley</b> , Berkeley, CA	05/2015
	<i>BS, Engineering Physics</i> <i>BA, Applied Mathematics</i> , Concentration in Numerical Analysis <ul style="list-style-type: none"><li>• Graduated Highest Honors in Applied Mathematics, Distinction in General Scholarship</li><li>• Thesis: <i>A Computational Study of Seizure Attenuation via Anderson Localization</i></li><li>• Advisors: Mohammad-Reza Alam (Mechanical Engineering), Per-Olof Persson (Mathematics)</li></ul>	
RESEARCH INTERESTS	Rare event simulation, Bayesian computation, Generative modeling, Data-driven methods for dynamical systems	
RESEARCH EXPERIENCE	<b>Department of Mathematics &amp; Statistics, UMass Amherst</b>	Amherst, MA
	<i>Postdoctoral Research Associate</i>	09/2022 - Present
	Mentors: Markos Katsoulakis, Luc Rey-Bellet, Paul Dupuis (Brown University)	
	<b>Department of Aeronautics and Astronautics, MIT</b>	Cambridge, MA
	<i>Postdoctoral associate</i>	01/2022 - 08/2022
	<i>Research assistant</i>	09/2015 - 01/2022
	Supervised by Professor Youssef Marzouk in the Uncertainty Quantification group.	
	<b>Department of Mechanical Engineering, UC Berkeley</b>	Berkeley, CA
	<i>Undergraduate research assistant</i>	09/2013 - 08/2015
	Supervised by Professor Reza Alam.	
TEACHING EXPERIENCE	<b>Department of Aeronautics and Astronautics, MIT</b>	Cambridge, MA
	<i>Course developer</i>	12/2019 - 04/2020
	Designed and co-wrote curriculum for MIT xPro online course on Modeling, Simulation, and Machine learning for working professionals.	
	<i>Teaching assistant</i>	01/2019 - 05/2019
	Undergraduate probability & statistics for aerospace engineering. Awarded best teaching assistant award by the students.	
	<i>Course developer and co-instructor</i>	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.	

	<b>Seminar XL instructor</b>	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.	
	<b>Teaching assistant and grader</b>	09/2018 - 12/2018
	Graduate class on numerical methods for stochastic processes and inference. Also served as informal teaching assistant and held office hours.	
	<b>Subject Design Certificate Program</b>	07/2020
	From the MIT Teaching and Learning lab.	
	<b>Department of Mathematics, UC Berkeley</b>	Berkeley, CA
	<b>Teaching assistant</b>	01/2015 - 05/2015
	Second semester introductory calculus.	
PROFESSIONAL EXPERIENCE	<b>United Technologies Research Center, UTC</b>	Berkeley, CA
	<b>Applied Mathematics Intern</b>	06/2017 - 09/2017
	Researched queuing systems for modeling human operators. Also investigated using quantum computing for optimization.	
PUBLICATIONS	<b>Journal articles</b>	
	8. <b>B. Zhang</b> , Y. Marzouk, and K. Spiliopoulos. Geometry-informed irreversible perturbations for accelerated convergence of Langevin dynamics. <i>Statistics and Computing</i> , 32(5):78, 2022	
	7. <b>B. Zhang</b> , T. Sahai, and Y. Marzouk. A Koopman framework for rare event simulation in stochastic differential equations. <i>Journal of Computational Physics</i> , 456:111025, 2022	
	6. <b>B. Zhang</b> , M. Chamanzar, and M.-R. Alam. Suppression of epileptic seizures via anderson localization. <i>Journal of The Royal Society Interface</i> , 14(127):20160872, 2017	
	<b>Conference proceedings</b>	
	5. <b>B. Zhang</b> , T. Sahai, and Y. Marzouk. Sampling via controlled stochastic dynamical systems. In <i>I (Still) Can't Believe It's Not Better! NeurIPS 2021 Workshop</i>	
	4. <b>B. Zhang</b> , Y. Marzouk, B.-Y. Min, and T. Sahai. Rare event simulation of a rotorcraft system. In <i>2018 AIAA Non-Deterministic Approaches Conference</i> , 2018	
	<b>Preprints</b>	
	3. <b>B. Zhang</b> and M. Katsoulakis. A mean-field games laboratory for generative modeling. <i>arXiv preprint arXiv:2304.13534</i> , 2023	
	2. <b>B. Zhang</b> , Y. Marzouk, and K. Spiliopoulos. Transport map unadjusted Langevin algorithms. <i>arXiv preprint arXiv:2302.07227</i> , 2023	
	1. <b>B. Zhang</b> , T. Sahai, and Y. Marzouk. Computing eigenfunctions of the multidimensional Ornstein-Uhlenbeck operator. <i>arXiv preprint arXiv:2110.09229</i> , 2021	
MENTORING	Master's theses advised:	
	• Joshua W. (MIT)	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	SFB 1294 Data Assimilation Short-term Visiting Research Fellowship	2022

	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	Organizer of <i>Learning Learning Seminar</i>	2023–Present
	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</i> (SISC)	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
INVITED TALKS & SEMINARS	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>	
	7. <b>B. Zhang</b> . What is Bayesian computation? The What is... Graduate Seminar (TWIGS). UMass Amherst, Amherst MA, November 21, 2022.	
	6. <b>B. Zhang</b> , K. Spiliopoulos, and Y. Marzouk. Novel perturbations for accelerating Langevin sampling. Applied Mathematics and Computation Seminar, UMass Amherst, Amherst MA, October 18, 2022.	
	5. <b>B. Zhang</b> , K. Spiliopoulos, and Y. Marzouk. Transport map unadjusted Langevin algorithm. Aerospace Computational Design Laboratory Seminar, MIT, Cambridge MA, April 1, 2022.	
	4. <b>B. Zhang</b> , T. Sahai, and Y. Marzouk. A Koopman framework for sampling in stochastic dynamical systems. LIDS and Stats Tea Talk, MIT, Cambridge, MA, April 8, 2020.	
	3. <b>B. Zhang</b> , T. Sahai, and Y. Marzouk. A Koopman framework for sampling in stochastic dynamical systems. Aerospace Computational Design Laboratory Seminar, MIT, Cambridge MA, December 6, 2019.	
	2. <b>B. Zhang</b> , 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>B. Zhang</b> . Koopman operators and the problems related to their computation. Aerospace Computational Design Laboratory Seminar, MIT, Cambridge MA, December 7, 2018.	
	16. <b>B. Zhang</b> , K. Spiliopoulos, and Y. Marzouk. Transport map unadjusted Langevin algorithm: analysis and connections, 2022. SIAM Conference on Mathematics of Data Science, San Diego, CA.	
CONFERENCE & WORKSHOP PRESENTATIONS	15. <b>B. Zhang</b> , 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. Optimal Transport in Data Science, Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University, May 8-12, 2023.
6. Data Assimilation – Mathematical Foundation and Applications, Mathematisches Forschungsinstitut Oberwolfach (MFO, Oberwolfach Research Institute for Mathematics) , February 20-26, 2022.
5. “I Can't Believe It's Not Better” Workshop at the Neural Information Processing Systems Conference (NeurIPS) 2021, held virtually, December 13, 2021.
4. Second Symposium on Machine Learning and Dynamical Systems, Fields Institute for Research in Mathematical Sciences, University of Toronto, September 21-29, 2020.
3. 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.
2. Optimal Transport: Numerical Methods and Applications, Lake Como School of Advanced Studies, May 7-11, 2018.

1. USACM Workshop on Uncertainty Quantification and Data-Driven Modeling, Austin TX, March 23-24, 2017.
0. Summer School in Monte Carlo Methods for Rare Events, Division of Applied Mathematics, Brown University, June 13-17, 2016.