

Benjamin Jiahong Zhang

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EDUCATION

Massachusetts Institute of Technology, Cambridge, MA

Expected 2021

PhD, Computational Science and Engineering

- Thesis committee: Youssef Marzouk (Chair), Tuhin Sahai, Themis Sapsis

SM, Aeronautics and Astronautics

2017

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

University of California, Berkeley, Berkeley, CA

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, Computational dynamical systems, Data assimilation

RESEARCH EXPERIENCE

Department of Aeronautics and Astronautics, MIT

Cambridge, MA

Graduate research assistant

2015 - Present

Supervised by Professor Youssef Marzouk in the Aerospace Computational Design Laboratory (ACDL). Currently studying importance sampling and multilevel splitting approaches for rare events in dynamical systems and Bayesian computation based on Koopman operator theory.

Department of Mechanical Engineering, UC Berkeley

Berkeley, CA

Undergraduate research assistant

2013 - 2015

Supervised by Professor Reza Alam. Studied noninvasive seizure attenuation methods via Anderson localization. Also did experimental study of cavity dynamics of spheres entering fluid surfaces.

TEACHING EXPERIENCE

Department of Aeronautics and Astronautics, MIT

Cambridge, MA

Course developer

2019 - 2020

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

Teaching assistant

Spring 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 "A hands-on introduction to computational engineering," an introductory course targeting first and second year undergraduates.

Grader

Fall 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

Summer 2020

Offered by the MIT Teaching and Learning lab.

Department of Mathematics, UC Berkeley

Berkeley, CA

Grader

Summer 2015

Upper division class on introduction to complex analysis.

Teaching assistant

Spring 2015

Second semester introductory calculus.

PROFESSIONAL EXPERIENCE	United Technologies Research Center, UTC	Berkeley, CA
	<i>Applied Mathematics Intern</i> Researched queuing systems for modeling human operators. Also investigated using quantum computing for optimization.	Summer 2017
	California State Assembly	Sacramento, CA
	<i>Legislative Intern</i> Analyzed policy and wrote briefs related to natural resources, environmental regulation, hydraulic fracturing, and services for the developmentally disabled. Responded to constituent affairs.	Summer 2013
MENTORING	Undergraduate research students advised:	
	<ul style="list-style-type: none"> Joshua White (MIT UROP and SuperUROP student) Karolina Podsada (MIT UROP) 	2019 - 2021 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	Organizer of the Uncertainty Quantification Reading Group	2019 - Present
	SIAM CSE 2021 Minisymposium organizer	2021
	Title: <i>Computational Dynamics meets Computational Statistics</i> (8 talks)	
	Journal referee for SIAM Journal on Scientific Computing (SISC)	2021
	Journal referee for Physica D: Nonlinear Phenomena	2020
	SIAM CSE 2019 Minisymposium organizer	2019
	Title: <i>Advances in Rare Event Simulation for Complex Dynamical Systems</i> (8 talks)	
	ACDL Undergraduate Research Opportunity Coordinator (UROP)	2017 - Present
	Seminar XL Instructor, MIT Office of Minority Education	2018 - 2019
PUBLICATIONS	Association of Computational Science and Engineering Students Co-President	2017 - 2018
	6. B. Zhang , Y. Marzouk, and K. Spiliopoulos. Geometry-informed irreversible perturbations for accelerated convergence of Langevin dynamics. In preparation.	
	5. B. Zhang , T. Sahai, and Y. Marzouk. Computing the eigenfunctions of the multidimensional Ornstein-Uhlenbeck operator. In preparation.	
	4. B. Zhang , T. Sahai, and Y. Marzouk. Sampling via controlled stochastic dynamical systems. In preparation.	
	3. B. Zhang , T. Sahai, and Y. Marzouk. A Koopman framework for rare event simulation in stochastic differential equations. <i>arXiv preprint arXiv:2101.07330</i> , 2021	
	2. B. Zhang , 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	
INVITED TALKS AND SEMINARS	1. B. Zhang , M. Chamanzar, and M.-R. Alam. Suppression of epileptic seizures via Anderson localization. <i>Journal of The Royal Society Interface</i> , 2017	
	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

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

5. Second Symposium on Machine Learning and Dynamical Systems, Fields Institute for Research in Mathematical Sciences, University of Toronto, September 21-29, 2020.
4. Workshop on 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.