Shanyin Tong

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APPOINTMENT

Assistant Professor, Department of Mathematics, University of Pennsylvania, Philadelphia, PA

July 2025 –

Chu Assistant Professor, Department of Applied Physics and Applied Mathematics, Columbia University, New York, NY

July 2022 – June 2025

EDUCATION

Ph.D. in Applied Mathematics, Courant Institute of Mathematical Sciences, New York University, New York, NY

August 2017 – May 2022

B.S. in Computational Mathematics, School of Mathematical Sciences, Peking University, Beijing, China

September 2013 – June 2017

RESEARCH INTERESTS

Applied and computational mathematics; Inverse problems in physics, engineering and data science; Extreme event estimation and control; Uncertainty quantification; PDE-constrained optimization; Optimization under uncertainty; Applied probability and statistics; Machine learning in scientific computing; Inference and sampling; Model reduction

GRANTS

NSF DMS-2529292 (lead PI) (co-PI: Xuan Sharon Di), 2025-2028. Project Title: *MATH-DT: RareDT: Rare event quantification and control in digital twins*.

HONORS & AWARDS

SIAM Most Read and High Impact Article for [8], SIAM/ASA Journal on UQ, US	2024
Second Prize for Leslie Fox Prize for [8], Institute of Mathematics and its Applications (IMA), Glasgow, UK	2023
AMS-Simons Travel Grant, American Mathematical Society (AMS) & Simons Foundation, US	2023-2025
NSF-AWM Travel Grant, Association for Women in Mathematics & National Science Foundation, US	2023
SIAM Early Career Travel Award, SIAM Conferences: UQ24, ICIAM23 and OP23, US	2023-2024
Finalist for ICCOPT Best Paper [11], International Conference on Continuous Optimization, Bethlehem, PA	2022
Kurt O. Friedrichs Prize, Outstanding Dissertation in Mathematics, Courant, New York, NY	2022
Rising Star in Computational and Data Sciences, Academic Workshop for Women, Albuquerque, NM	2022
Bella Manel Prize, Excellence and Promise in Mathematics on the Graduate Level, Courant, New York, NY	2020
SIAM Student Travel Award, SIAM Conferences: UQ22, CSE21 and UQ20, US	2020-2022
Isaac Barkey and Ernesto Yhap Fellowship, Outstanding Math PhD Student, Courant, New York, NY	2019
Meritorious Winner, The Interdisciplinary Contest in Modeling (ICM), Beijing, China	2016
WeTech Qualcomm Global Scholar Award, IIE and Qualcomm, Beijing, China	2015
First Prize, 7th National Mathematics Contest for College Students, Beijing, China	2015
Third Prize, 31st National Physics Contest for College Students, Beijing, China	2014
Yizheng Alumni Scholarship, Peking University, Beijing, China	2014

PUBLICATIONS

1. S. Rakshith, A. Deo, S. Tong, K. Murthy and A. Subramanyam, *Self-structured importance sampling for chance-constrained optimization*, in preparation.

2. S. Tong, I. Papaioannou and and K. Papakonstantinou, *Importance sampling for reliability analysis in high dimensions*, in preparation.

3. A. Jin and S. Tong, *Rare event probability estimation using normalizing flows*, in preparation.

4. K. Ren, N. Soedjak and S. Tong, *A policy iteration method for inverse mean field games*, submitted (2024). [arXiv:2409.06184]

5. Y. Pan, K. Ren and S. Tong, *A three-stage method for reconstructing multiple coefficients in coupled photoacoustic and diffuse optical imaging*, Inverse Problems 41 035008 (2025). [arXiv:2408.03496 | Inverse Probl. Link]

6. A. Chowdhary, S. Tong, G. Stadler and A. Alexanderian, *Sensitivity analysis of the information gain in infinite-dimensional Bayesian linear inverse problems*, International Journal for Uncertainty Quantification 14.6:17-35 (2024). [arXiv:2310.16906 | IJUQ Link]

7. T. Schorlepp, S. Tong, T. Grafke and G. Stadler, *Scalable methods for computing sharp extreme event probabilities in infinite-dimensional stochastic systems*, Statistics and Computing 33.137 (2023). [arXiv:2303.11919 | Stat.Comput. Link]

8. S. Tong and G. Stadler, *Large deviation theory-based adaptive importance sampling for rare events in high dimensions*, SIAM/ASA Journal on Uncertainty Quantification 11.3: 788-813 (2023). [arXiv:2209.06278 | JUQ Link]

9. S. Tong, E. Vanden-Eijnden and G. Stadler, *Estimating earthquake-induced tsunami height probabilities without sampling*, Pure and Applied Geophysics 180.5:1587-1597 (2023). Included in the special issue "Sixty Years of Modern Tsunami Science, Volume 2: Challenges". [arXiv:2111.14325 | PAG Link]

10. S. Tong, *Extreme event probability estimation and control using large deviation theory and PDE-constrained optimization*, Doctoral dissertation (2022). [ProQuest Link]

11. S. Tong, A. Subramanyam and V. Rao, *Optimization under rare chance constraints*, SIAM Journal on Optimization 32.2:930-958 (2022). [arXiv:2011.06052 | SIOPT Link]

12. S. Tong, E. Vanden-Eijnden and G. Stadler, *Extreme event probability estimation using PDE-constrained optimization and large deviation theory, with application to tsunamis*, Communications in Applied Mathematics and Computational Science 16.2:181–225 (2021). [arXiv:2007.13930 | CAMCoS Link]

13. S. Tong, *Extreme event probability estimation with application to tsunamis*, SIAM News (2021). Featured on the homepage of SIAM News. [SIAM News link]

PRESENTATIONS & TALKS

2025 Research Collaboration Workshop in the Science of Data and Mathematics (WiSDM), UNC-Chapel Hill, NC	August 2025
The 2025 AWM Research Symposium, University of Wisconsin-Madison, Madison, WI	May 2025
SIAM Conference on Applications of Dynamical Systems (DS25), Denver, CO	May 2025
NSF CompMath Meeting 2025, University of Utah, UT	May 2025
PSU-Purdue-UMD Joint Seminar on Mathematical Data Science (virtual)	April 2025
East Coast Optimization Meeting 2025, CMAI, George Mason University, Arlington, VA	April 2025
Fluid Mechanics and Waves Seminar, Department of Mathematical Sciences, NJIT, Newark, NJ	April 2025
PDEs and Applied Math Seminar, Department of Mathematics, Drexel University, Philadelphia, PA	April 2025
SIAM Conference on Computational Science and Engineering (CSE25), Fort Worth, TX	March 2025
Colloquium, School of Mathematics, University of Minnesota, Minneapolis, MN	January 2025
Probability and Combinatorics Seminar, Department of Mathematics, University of Pennsylvania, Philadelphia, PA	January 2025

Seminar, School of Data Science and Society & Department of Mathematics, University of North Carolina at Chapel Hill, Chapel Hill, NC	January 2025
Applied Math Colloquium, Department of Mathematics, UCLA, Los Angeles, CA	January 2025
Guest Lecture, Department of Mathematics, UC Berkeley, Berkeley, CA	December 2024
CMOR Special Lecture, Department of Computational Applied Mathematics & Operations Research, Rice University, Houston, TX	December 2024
Colloquium, Department of Mathematics, University of South Carolina, Columbia, SC	December 2024
Colloquium, Department of Mathematics, University of Wisconsin-Madison, Madison, WI	December 2024
Colloquium, Department of Mathematics, The Pennsylvania State University, State College, PA	December 2024
Colloquium, Mathematical Sciences Department, The University of Texas at Dallas, Richardson, TX	December 2024
NSF Workshop on Data-driven Modeling and Prediction of Rare and Extreme Events, IMSI, Chicago, IL	November 2024
CCAM seminar, Department of Mathematics, Purdue University, West Lafayette, IN	November 2024
SIAM Conference on Mathematics of Data Science (MDS24), Atlanta, GA	October 2024
SIAM Texas-Louisiana Section Annual Meeting, Baylor University, Waco, TX	October 2024
Engineering Speaks to K-12 students, Columbia University, New York, NY	August 2024
Empowering a Diverse Computational Mathematics Research Community Workshop, Providence, RI	July 2024
New England Numerical Analysis Day (NENAD), Dartmouth College, Hanover, NH	June 2024
Sayas Numerics Day, Workshop on Computational Mathematics, George Mason University, Arlington, VA	May 2024
2024 INFORMS Optimization Society Conference (IOS 2024), Houston, TX	March 2024
SIAM Conference on Uncertainty Quantification (UQ24), Trieste, Italy	February 2024
Mathematical Opportunities in Digital Twins Workshop, George Mason University, Arlington, VA	December 2023
Mid-Atlantic Numerical Analysis Day, Temple University, Philadelphia, PA	November 2023
SIAM New York-New Jersey-Pennsylvania Annual Meeting, New Jersey Institute of Technology, NJ	October 2023
2023 INFORMS Annual Meeting, Phoenix, AZ	October 2023
10th International Congress on Industrial and Applied Mathematics (ICIAM 2023), Tokyo, Japan	August 2023
Seminar Series on Young Scholars in Optimization and Data Science, Department of Applied Mathematics, The Hong Kong Polytechnic University, Hong Kong, China	July 2023
IMA Leslie Fox Prize meeting, Glasgow, UK	June 2023
SIAM Conference on Optimization (OP23), Seattle, WA	May 2023
Joint Mathematics Meetings (JMM2023), Boston, MA	January 2023
Seminar in Applied Mathematics, Columbia University, New York, NY	September 2022
APAM Research Conference, Columbia University, New York, NY	September 2022
Best Paper Session at International Conference on Continuous Optimization (ICCOPT), Bethlehem, PA	July 2022
Rising Stars in Computational and Data Sciences, Albuquerque, NM	April 2022
SIAM Conference on Uncertainty Quantification (UQ22), Atlanta, GA	April 2022
Scientific Computing and Numerics (SCAN) Seminar, Cornell University, Ithaca, NY (virtual)	March 2022
CCB Seminar at Center for Computational Biology, Simons Foundation, New York, NY	January 2022
Applied Mathematics Colloquium, Columbia University, New York, NY (virtual)	January 2022
SIAM Conference on Computational Science and Engineering (CSE21), Fort Worth, Texas (virtual)	March 2021
2020 INFORMS Annual Meeting, National Harbor, MD (virtual)	November 2020
Summer Argonne Students Symposium (SASSy), Argonne National Lab, Lemont, IL (virtual)	August 2020

NSF Research Training Group (RTG) in Modeling & Simulation, CIMS, NYU, , New York, NY		February 2020
ICERM Workshop: Mathematical Optimization of Systems Impacted by Rare Events, Providence, RI		June 2019
Gene Golub SIAM Summer School: Inverse Problems, Models under Uncertainty, Breckenridge, CO		June 2018

Teaching

2025 Fall	Instructor, AMCS 6045: Topics in Numerical Analysis and Scientific Computing: Machine learning approaches for inverse problems	UPenn
2025 Spring	Instructor, APMA-E4306: Applied Stochastic Analysis	Columbia University
2024 Fall	Instructor, APMA-E2000-001: Multivariable Calculus	Columbia University
2024 Spring	Instructor, APMA-E4306: Applied Stochastic Analysis	Columbia University
2023 Fall	Instructor, APMA-E2000-001: Multivariable Calculus	Columbia University
2023 Spring	Instructor, APMA-E4306: Applied Stochastic Analysis	Columbia University
2022 Fall	Instructor, APMA-E2000-001: Multivariable Calculus	Columbia University
2021 Fall	Recitation & lab instructor, MATH-UA.0253-002: Linear and Nonlinear Optimization	NYU
2021 Spring	Recitation & lab instructor, MATH-UA.0253-002: Linear and Nonlinear Optimization	NYU (virtual)
2021 Spring	Recitation instructor, MATH-UA.0263-002: Partial Differential Equations	NYU (virtual)
2021 Spring	Instructor, Graduate written exam workshop: Linear Algebra	CIMS, NYU (virtual)
2020 Fall	Teaching assistant & grader, MATH-GA.2010-001: Numerical Methods I	CIMS, NYU (virtual)
2019 Fall	Recitation instructor, MATH-UA.0121-032 & -034: Calculus I	NYU
2019 Fall	Instructor, Graduate written exam workshop: Complex Variables	CIMS, NYU
2019 Fall	Instructor, Graduate written exam workshop: Linear Algebra	CIMS, NYU
2018 Fall	Instructor, Graduate written exam workshop: Linear Algebra	CIMS, NYU
2018 Fall	Teaching assistant & grader, MATH-GA.2043-001: Scientific Computing	CIMS, NYU

Professional Service

Journal Referee	Computational Management Science
	International Journal for Uncertainty Quantification (IJUQ)
	Inverse Problems
	Journal of Computational Science (JOCSCI)
	Journal of Optimization Theory and Applications (JOTA)
	Machine Learning: Science and Technology (MLST)
	Psychometrika (PMET)
	SIAM Journal on Scientific Computing (SISC)
	Stochastic Systems
Grant Referee	Dutch Research Council (NWO)
Committee Member	APAM PhD Student Thesis Defense, Columbia University, New York, NY, 2023-2025: Ling Lan, Madison Ihrig, Yin Zhou
	APAM PhD Student Thesis Proposal, Columbia University, New York, NY, 2023-2025
	APAM PhD Student Oral Exams, Columbia University, New York, NY, 2023-2025
	APAM PhD Student Written Exams, Columbia University, New York, NY, 2023-present

Student Advising

Research Advise the following undergrad and graduate students for different research projects:

Zhinan Han (former master at Columbia, co-advised by Kui Ren, now PhD student at Duke math)

Andrew Jin (former undergrad at Columbia, now PhD student at Northwestern IEMS)

Joonsoo Lee (former undergrad at Columbia, Bonomi Scholar, now PhD student at MIT math)

Yifan Wang (former master at Columbia, now PhD student at UMich IOE)

Rui Xu (current master student at Penn)

Career Development Besides the above students, also provide career development advice for the following students:

Anna Mazhar (former undergrad at Columbia, now PhD student at Princeton math)

Panagiotis Tsimpo (former undergrad at Columbia, now PhD student at MIT OR)

Serena Yihe Yang (undergrad at Columbia)

Max Zhao (former undergrad at Columbia, now PhD student at UT Austin Oden Institute)

CONFERENCE & SEMINAR ORGANIZING

Co-organizer, Minisymposium at SIAM CSE25 Conference, Fort Worth, TX	March 2025
Co-organizer, Minisymposium at SIAM Texas-Louisiana Section Annual Meeting, Waco, TX	October 2024
Co-organizer, Minisymposium at Engineering Mechanics Institute Conference and Probabilistic Mechanics & Reliability Conference (EMI/PMC 2024), Chicago, IL	May 2024
Co-organizer, Applied Mathematics Colloquium, Columbia University, New York, NY	2023 -present
Co-organizer, Minisymposium at SIAM-NNP Section Annual Meeting, Newark, NJ	June 2023
Co-organizer, Minisymposium at SIAM Conference on Optimization, Seattle, WA	June 2023
Proposer & Co-organizer, APAM Research Symposium, Columbia University, New York, NY	2023-present
Co-organizer, APAM Research Conference, Columbia University, New York, NY	2022-present