Professor Jinqiao Duan 段金桥

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Ranked in the World's Top 2% Scientists list since 2019

October 24, 2026

RESEARCH INTERESTS

Applied Mathematics: Stochastic Dynamics; AI and Machine learning Inspired by Stochastic Dynamics; Stochastic Partial Differential Equations; Stochastic Biophysical & Geophysical Systems; Critical Transitions and Tipping Phenomena in Non-Equilibrium Statistical Mechanics; Nonautonomous and Stochastic Quantum Dynamics.

EDUCATION

- **Ph.D. in Applied Mathematics**, Cornell University, 1993 (Advisor: Philip Holmes)
- **M.S. in Mathematics**, University of Massachusetts at Amherst, 1990
- **M.S. in Mathematical Physics**, Chinese Academy of Sciences, 1988
- **B.S. in Computational Mathematics**, Wuhan University, China, 1983

EMPLOYMENT

- **Chair Professor & Executive Dean of School of Sciences** (2022–Present)
  Great Bay University, Dongguan, China
- **Director** (2003–2021)
  Center for Stochastic Dynamics, Illinois Inst. of Tech.
- **Gary Havener Department Chair** (offer, 2021)
  Missouri University of Science and Technology, Rolla, Missouri
- **Associate Director** (2011–2013)
  NSF Institute for Pure and Applied Mathematics (IPAM), UCLA, Los Angeles
- **Associate Professor** (2000–2002)
  Illinois Institute of Technology
- **Guest Faculty Fellow** (2001–2022)
  Argonne National Laboratory
- **Associate/Assistant Professor** (1995–2000)
  Clemson University
- **Postdoc with Steve Wiggins** (1993–1995)
  California Institute of Technology

LEADERSHIP & ACADEMIC ADMINISTRATION

Director, Guangdong Provincial Lab of Mathematical and Neural Dynamical Systems (2024–Present)

Associate Director, Institute for Pure and Applied Mathematics (IPAM), UCLA (2011–2013)

- Managed academic programs and summer schools, researched emerging areas, and suggested program initiatives to capitalize on breakthroughs in mathematics, engineering, and science.
- Managed multiple programs including summer schools on ”Deep Learning & Feature Learning” (2012) and ”Computer Vision” (2013).
- Oversaw long programs on Genomics (2011), Computational Methods in High Energy Density Plasmas (2012), and Interactions between Analysis and Geometry (2013).
- Managed Research in Industrial Projects for Students (RIPS) programs for undergraduates.
- Facilitated connections with corporate partners (Google, Microsoft, IBM, Aerospace) to secure funding for undergraduate industrial projects.

Director, Center for Stochastic Dynamics, Illinois Inst. of Tech. (2003–2021)

- Facilitated interdisciplinary research collaborations, notably with the Department of Chemical and Biological Engineering (joint million-dollar grant) and Argonne National Laboratory (8-year NSF joint funding).
- Awarded grant from International Union of Mathematicians to host 1 Abel Fellow in 2018.
- Awarded grants from American Mathematical Society to host 3 Ky Fan Fellows (2003, 2017, 2020).
- Awarded grants to organize 3 NSF-funded Conferences/Summer Schools in Mathematical Sciences.
- Attracted and hosted over 50 research visitors, including 15 long-term year-long visitors.

EDITORIAL SERVICES

- **Managing Editor and Now Co-Editor-in-Chief**, *Stochastics and Dynamics* (World Scientific), 2000–Present.
- **Editorial Board Member**, *Cognitive Neurodynamics*, 2025–Present.
- **Editorial Board Member**, *Geometric Mechanics*, 2025–Present.
- **Editorial Board Member**, *Journal of Data and Dynamic Systems*, 2025–Present.
- **Founding Editor-in-Chief**, Book series *Interdisciplinary Mathematical Sciences* (World Scientific), 2000–Present.
- **Editorial Board Member**, *Nonlinear Processes in Geophysics*, 2010–Present.

AWARDS & FELLOWSHIPS

- **World's Top 2% Scientists List** (Career long or single year impacts), 2019, 2020, 2023 and 2025.
- **James Simons Fellow**, 2026.
- **Sigma Xi Award for Excellence in Research** (Senior Faculty Category), IIT, 2011.
- **Dean's Excellence Award for Research**, Illinois Institute of Technology, 2005.
- **Leverhulme Trust Fellowship** (via London Math Society) to visit Loughborough Univ., Warwick Univ., and Univ. of Wales-Swansea, 2009.
- **K. C. Wong Education Foundation Fellowship** (Hong Kong), 2007.
- **The Young Scientists' Publication Award**, European Geophysical Society, 1999.
- **Invited Visiting Positions**: Newton Institute, ICERM (Brown University), Univ. of Gottingen, Sorbonne Université, Universite Paris-Sud, Humboldt University, University of Pisa, Moscow State University, and others.

TEACHING, EDUCATION & MENTORSHIP

- **Teaching Innovation Award**, Clemson University, 1998; Established a SIAM Local Chapter.
- Supervised over 50 PhD students and served on numerous PhD committees in engineering and science (Biomedical Eng, CS, ECE, Biophysics, Physics, Mech Eng).
- Supervised over 10 postdocs and 20 long-term (one year or longer) visitors.
- Supervised over 20 undergraduate students in research projects.
- Taught core courses spanning Stochastic Calculus, Stochastic Dynamics, Calculus, Mathematical Analysis, Linear Algebra, ODEs, Probability, Functional Analysis, Stochastic PDEs, and Dynamical Systems.

RECENT RESEARCH GRANTS

- NSFC grants in stochastic dynamics, stochastic partial differential equations, machine learning and stochastic dynamics, stochastic biological dynamics, brain dynamics, critical transitions and tipping phenomena.
- NSF Award, Institute for Data, Econometrics, Algorithm and Learning, $5M, 2022–2027.
- Data-Intensive Scientific Machine Learning Research and Analysis - Inertial neural surrogates for stable dynamical prediction, $3.6M, 2021–2024.
- Theoretical and numerical studies of nonlocal equations derived from SDEs with Lévy noises, NSF DMS-1620449, $210,000, 2016–2020.
- NSF-CBMS Conference: Nonlocal Dynamics - Theory, Computation and Applications, DMS-1642545, $35,000, 2016–2017.
- Collaborative Research: Mathematical Modeling by Bridging Primitive and Boussinesq Equations (Lead PI), NSF DMS-1025422, $850,000, 2010–2015.

AUTHORED & EDITED BOOKS

[1] **Geometric methods for stochastic dynamical systems — A Concise Introduction** (with Ting Gao, Qiao Huang and Yuanfei Huang), Springer Nature, 2026.

[2] **An Introduction to Stochastic Dynamics**, Cambridge University Press, 2015.

[3] **Effective Dynamics of Stochastic Partial Differential Equations** (with Wei Wang), Elsevier, 2014.

[4] **Probability and Partial Differential Equations in Modern Applied Mathematics** (with E. Waymire, Eds.), Springer-Verlag, 2005.

SELECTED PUBLICATIONS (TOP-TIER JOURNALS)

Selected from publications in leading math, physics, and interdisciplinary journals.

[1] Wang H, Wang Y, Chen X, Duan J. Detecting the most probable transition phenomenon in a nutrient–phytoplankton–zooplankton system. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 384(2322): 20240500, 2026. DOI: 10.1098/rsta.2024.0500.

[2] Duan J, Gao T. Critical transitions and intelligent control in complex systems. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 384(2322): 20260062, 2026. DOI: 10.1098/rsta.20260062.

[3] Wang Y, Gao T, Duan J. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 384(2322): 20250375, 2026. DOI: 10.1098/rsta.2025.0375.

[4] Cheng J, Gao T, Duan J. Adaptive control for multi-scale stochastic dynamic systems with stochastic next generation reservoir computing. *Physica D: Nonlinear Phenomena*, 135206, 2026.

[5] Chao Y, Duan J, Gao T, Wei P. Well-posedness and averaging principle for non-Gaussian McKean–Vlasov stochastic differential equations with locally Lipschitz coefficients. *Advances in Applied Probability*, 58(1): 301–344, 2026.

[6] Zhang Y, Liu D, Liang Z, Cheng J, Lou K, Duan J, Gao T, Hu B, Liu Q. Artificial intelligence as a surrogate brain: bridging neural dynamical models and data. *National Science Review*, 13(3): nwaf457, 2026.

[7] Chao Y, Duan J, Wei P. Most probable escape paths in perturbed kinetic Langevin systems. *Applied Mathematics Letters*, 109782, 2025.

[8] Zhang P, Gao T, Guo J, Duan J. Action functional as an early warning indicator in the space of probability measures via Schrödinger bridge. *Quantitative Biology*, 13(3): e86, 2025.

[9] Tesfay D, Serdukova L, Zheng Y, Wei P, Duan J, Kurths J. Influence of extreme events modeled by Lévy flight on Atlantic meridional overturning circulation stability. *Physica D: Nonlinear Phenomena*, 134849, 2025.

[10] Li Y, Xu S, Duan J. An evolutionary approach for discovering non-Gaussian stochastic dynamical systems based on nonlocal Kramers–Moyal formulas. *Communications in Nonlinear Science and Numerical Simulation*, 145: 108751, 2025.

[11] Huang Y, Zhou X, Duan J. Probability flow approach to the Onsager–Machlup functional for jump-diffusion processes. *SIAM Journal on Applied Mathematics*, 85(2): 524–547, 2025.

[12] Lu W, Wu X, Ding D, Duan J, Zhuang J, Yuan G. Diffusion model conditioning on Gaussian mixture model and negative Gaussian mixture gradient. *Neurocomputing*, 614: 128764, 2025.

[13] Yang L, Gao T, Wei W, Dai M, Fang C, Duan J. Multi-task meta label correction for time series prediction. *Pattern Recognition*, 150: 110319, 2024.

[14] Chen Y, Duan J, Gao H, Guo X. Modulation analysis of the stochastic Camassa–Holm equation with pure jump noise. *Journal of Nonlinear Science*, 34(3): 58, 2024.

[15] Chao Y, Duan J, Wei P. Small-noise-induced metastable transition of periodically perturbed systems. *SIAM Journal on Applied Dynamical Systems*, 23(1): 961–981, 2024.

[16] Feng L, Gao T, Xiao W, Duan J. Early warning indicators via latent stochastic dynamical systems. *Chaos: An Interdisciplinary Journal of Nonlinear Science*, 34(3), 2024.

[17] Chen J, Gao T, Li Y, Duan J. Detecting the most probable transition pathway based on optimal control theory. *Applied Mathematical Modelling*, 127: 217–236, 2024.

[18] Huang Y, Huang Q, Duan J. The most probable transition paths of stochastic dynamical systems: a sufficient and necessary characterisation. *Nonlinearity*, 37(1): 01501, 2024.

[19] Chen Y, Duan J, Gao H. Well-posedness and wave-breaking for the stochastic rotation-two-component Camassa-Holm system. *The Annals of Applied Probability*, 33(4): 2734–2785, 2023.

[20] Li Y, Xu S, Duan J, et al. A data-driven framework for learning hybrid dynamical systems. *Chaos: An Interdisciplinary Journal of Nonlinear Science*, 33(6), 2023.

[21] Chen S, Duan J. Perturbation of the spectra for asymptotically constant differential operators and applications. *Physica D: Nonlinear Phenomena*, 448: 133735, 2023.

[22] Lin L, Duan J, Yang M. Effective approximation for a nonlocal stochastic Schrödinger equation with oscillating potential. *Zeitschrift für Angewandte Mathematik und Physik (ZAMP)*, 74(1): 1–20, 2023.

[23] Lu Y, Li Y, Duan J. Extracting stochastic governing laws by non-local Kramers-Moyal formulae. *Philosophical Transactions of the Royal Society A*, 380: 20210195, 2022.

[24] Wang J, Li D, Duan J. Compactly generated shape index theory and its application to a retarded nonautonomous parabolic equation. *Topological Methods in Nonlinear Analysis*, 59(1): 1–33, 2022.

[25] Li Y, Duan J. Extracting Governing Laws from Sample Path Data of Non-Gaussian Stochastic Dynamical Systems. *Journal of Statistical Physics*, 186: 30, 2022.

[26] Huang Y, Chao Y, Wei W, Duan J. Estimating the Most Probable Transition Time for Stochastic Dynamical Systems. *Nonlinearity*, 34: 4543, 2021.

[27] Chen X, Yang L, Duan J, Karniadakis GE. Solving Inverse Stochastic Problems from Discrete Particle Observations Using the Fokker-Planck Equation and Physics-informed Neural Networks. *SIAM Journal on Scientific Computing*, 43(3): B811–B830, 2021.

[28] Li Y, Duan J, Liu X. A Machine Learning Framework for Computing the Most Probable Paths of Stochastic Dynamical Systems. *Physical Review E*, 103: 012124, 2021.

[29] Zhang Q, Duan J. Linear Response Theory for Nonlinear Stochastic Differential Equations with α-stable Lévy Noises. *Journal of Statistical Physics*, 182: 32, 2021.

[30] Zheng Y, Yang F, Duan J, Fu L, Kurths J. The maximum likelihood climate change for global warming under the influence of greenhouse effect and Lévy noise. *Chaos*, 30: 013132, 2020.

[31] Zhang Y, Qiao H, Duan J. Effective filtering analysis for non-Gaussian dynamic systems. *Applied Mathematics and Optimization*, 2019.

[32] Lv G, Chen H, Duan J. Boundary blow-up solutions to nonlocal elliptic systems of cooperative type. *Annales Henri Poincaré*, 19: 2115–2136, 2018.

[33] Qiao H, Zhang Y, Duan J. Effective filtering on a random slow manifold. *Nonlinearity*, 31: 4649–4666, 2018.

[34] Wei J, Duan J, Lv G. Kinetic solutions for nonlocal scalar conservation laws. *SIAM Journal on Mathematical Analysis*, 50: 1521–1543, 2017.

[35] Bai L, Cheng X, Duan J, Yang M. Slow manifold for a nonlocal stochastic evolutionary system with fast and slow components. *Journal of Differential Equations*, 263: 4870–4893, 2017.

[36] Qiao H, Duan J. Stationary Measures for Stochastic Differential Equations with Jumps. *Stochastics*, 88(6): 864–883, 2016.

[37] Lv G, Duan J, Gao H, Wu JL. On a stochastic nonlocal conservation law in a bounded domain. *Bulletin des Sciences Mathématiques*, 140: 718–746, 2016.

[38] Liu Y, Zou W, Zhan M, Duan J, Kurths J. Enhancing dynamical robustness in aging networks of coupled nonlinear oscillators. *Europhysics Letters*, 114: 40004, 2016.

[39] Zou W, Senthilkumar DV, Nagao R, Kiss IZ, Tang Y, Koseska A, Duan J, Kurths J. Restoration of rhythmicity in diffusively coupled dynamical networks. *Nature Communications*, 6: 7709, 2015.

[40] Chen G, Duan J, Zhang J. Slow foliation of a slow-fast stochastic evolutionary system. *Journal of Functional Analysis*, 267: 2663–2697, 2014.

[41] Gao T, Duan J, Li X, Song R. Mean exit time and escape probability for dynamical systems driven by Lévy noise. *SIAM Journal on Scientific Computing*, 36(3): A887–A906, 2014.

[42] Kan X, Duan J, Kevrekidis IG, Roberts AJ. Simulating Stochastic Inertial Manifolds by a Backward-Forward Approach. *SIAM Journal on Applied Dynamical Systems*, 12(1): 487–514, 2013.

[43] Chen G, Duan J, Zhang J. Approximating dynamics of a singularly perturbed stochastic wave equation with a random dynamical boundary condition. *SIAM Journal on Mathematical Analysis*, 45(5): 2790–2814, 2013.

[44] Wang W, Roberts AJ, Duan J. Large deviations and approximations for slow-fast stochastic reaction-diffusion equations. *Journal of Differential Equations*, 253: 3501–3522, 2012.

[45] Sun C, Yang L, Duan J. Asymptotic behavior for a semilinear second order evolution equation. *Transactions of the American Mathematical Society*, 363(11): 6085–6109, 2011.

[46] Chen X, Duan J, Fu X. A sufficient condition for bifurcation in random dynamical systems. *Proceedings of the American Mathematical Society*, 138: 965–973, 2010.

[47] Duan J, Millet A. Large deviations for the Boussinesq equations under random influences. *Stochastic Processes and their Applications*, 119: 2052–2081, 2009.

[48] Wang W, Duan J. Homogenized dynamics of stochastic partial differential equations with dynamical boundary conditions. *Communications in Mathematical Physics*, 275: 163–186, 2007.

[49] Duan J, Nadiga B. Stochastic parameterization for large eddy simulation of geophysical flows. *Proceedings of the American Mathematical Society*, 135: 1187–1196, 2007.

[50] Duan J, Lu K, Schmalfuss B. Invariant manifolds for stochastic partial differential equations. *Annals of Probability*, 31: 2109–2135, 2003.

RECENT INVITED OR CONTRIBUTED PRESENTATIONS (SELECTED)

- **ICIAM Tokyo, Japan** (Aug 2023): Minisymposium speaker, *Transition phenomena in non-Gaussian stochastic dynamical systems.*
- **28th International Conference on Statistical Physics**, Tokyo, Japan (Aug 2023): Contributed speaker, *Transition phenomena in non-Gaussian stochastic dynamical systems.*
- **The 45th Anniversary Symposium of Yamada Science Foundation**, Tokyo (Aug 2023): Contributed speaker, *The Most Probable Transition Pathways in Non-Gaussian Stochastic Dynamical Systems.*
- **International Conference: Differential Equations for Data Science 2023**, Japan (Feb 2023): *Nonlocal Kramers-Moyal formulas and data science.*
- **AMS Fall Central Sectional Meeting**, Texas, USA (Sept 2022): Special Session on Stochastic Dynamics. *Geometric Aspects for Stochastic Hamiltonian Dynamics.*
- **Newton Institute, Cambridge Univ, UK** (Apr 2022): *Fractional Differential Equations Arising in Stochastic Dynamical Systems.*
- **Workshop on Computation, Analysis & Applications of PDEs with Nonlocal and Singular Operators**, Singapore (Feb 2022).
- **Institute for Computational and Experimental Mathematics (ICERM)**, Brown University (Fall 2021). Invited long term visitor for the program ”Hamiltonian Methods in Dispersive and Wave Evolution Equations”.
- **Distinguished Lecture**, Hong Kong SIAM and Univ of HK (Feb 2021).
- **Second Symposium on Machine Learning and Data Science**, Fields Institute, Canada (Sept 2020): *Extracting stochastic governing laws from data by a nonlocal Kramers-Moyal formula.*
- **SIAM Conference on Mathematics of Data Science**, Cincinnati, Ohio (May 2020).
- **Joint Mathematics Meetings**, Denver, Colorado (Jan 2020): Invited presentation at the Special Session on Stochastic Differential Equations.