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Wai-Tong (Louis) Fan

Academic qualifications

- Ph.D.** in Mathematics, University of Washington-Seattle, WA Fall 08-Spr 14
Advisors: Zhen-Qing Chen and Krzysztof Burdzy
- M.Phil.** in Mathematics, Hong Kong University of Science and Technology Fall 03-Spr 05
Advisor: Shiu-Yuen Cheng
- B.Sc.** in Mathematics, Chinese University of Hong Kong Fall 00-Spr 03

Employment and academic positions

- Assistant professor**, Indiana University-Bloomington, IN Fall 18-present
- Research associate**, Harvard University, Cambridge, MA Fall 20-Spr 22
- Van Vleck visiting assistant professor**, University of Wisconsin-Madison, WI Fall 15-Sum 18
- Postdoctoral Associate**, University of North Carolina-Chapel Hill, NC Fall 14-Spr 15
- Director of curriculum design**, Profound Education and Consulting Ltd. Fall 05-Spr 08

Research interests: Probability theory and applications

Stochastic analysis for complex systems; Interacting particle systems; Stochastic partial differential equations; Phylogenetics; Population genetics and genomics

Publications

1. Stochastic PDEs on graphs as scaling limits of discrete interacting systems. *Bernoulli*. 27(3), 899-1941, 2021.
2. Wave propagation for reaction-diffusion equations on infinite trees. With W. Hu and G. Terlov. *Communications in Mathematical Physics*. 384, 2021.
3. Three-dimensional shear driven turbulence with noise at the boundary. With M. Jolly and A. Pakzad. *Nonlinearity*. Vol 34 (7), 2021.
4. Hitting time of rapid intensification onset in hurricane-like vortices. With C. Kieu, D. Sakellariou and M. Patra. *Physics of Fluids*. 2021.

5. Modeling atmospheric data and identifying dynamics large temporal data-driven modeling of air pollutants. With J. Rubio-Herrero and C. O. Marrero. *Journal of Cleaner Production*, 2021.
6. Impossibility of consistent distance estimation from sequence lengths under the TKF91 model. With B. Legried and S. Roch. *Bulletin of Mathematical Biology*. Vol. 82 (9), 2020.
7. Statistically consistent and computationally efficient inference of ancestral DNA sequences in the TKF91 model under dense taxon sampling. With S. Roch. *Bulletin of Mathematical Biology*. Vol. 82 (2), 2020.
8. Joint distribution of Busemann functions in the exactly solvable corner growth model. With T. Seppäläinen. *Probability and Mathematical Physics*. 2020.
9. Stochastic Variability of Tropical Cyclone Intensity at the Maximum Potential Intensity Equilibrium. With P. Nguyen and C. Kieu. *Journal of the Atmospheric Sciences*. 77 (9), 3105-3118, 2020.
10. Necessary and sufficient conditions for consistent root reconstruction in Markov models on trees. With S. Roch. *Electronic Journal of Probability*. Vol. 23 (47), 1-24, 2018.
11. Stochasticity promotes the evolution of cooperation in a multilevel model of the Snowdrift Game. With B. McLoone, A. Pham, S. Rory and L. Loewe. *Complexity*. 2018.
12. Systems of interacting diffusions with partial annihilations through membranes. With Z.-Q. Chen. *Annals of Probability*. Vol. 45, 100-146, 2017.
13. Hydrodynamic limits and propagation of chaos for interacting random walks in domains. With Z.-Q. Chen. *Annals of Applied Probability*. Vol. 27 (3), 1299-1371, 2017.
14. Large deviations for Brownian particle systems with killing. With A. Budhiraja and R. Wu. *Journal of Theoretical Probability*. 1-40, 2017.
15. Uniform in time interacting particle approximations for nonlinear equations of Keller-Segel type. With A. Budhiraja. *Electronic Journal of Probability*, Vol. 22 (8), 1-37, 2017.
16. Ellipsoidal Brownian self-driven particles in a magnetic field. With O. Pak and M. Sandoval. *Physical Review E*, 95 (3), 032605, 2017.
17. Genealogies in expanding populations. With R. Durrett. *Annals of Applied Probability*. Vol. 26 (6), 3456-3490, 2016.
18. Fluctuation limit for systems of interacting diffusions with partial annihilations through membranes. With Z.-Q. Chen. *Journal of Statistical Physics*. 164, 890-936, 2016.
19. Discrete approximations to local times for reflected diffusions. *Electronic Communications in Probability*. Vol. 21 (16), 2016.
20. Mucins and associated glycan signatures in colon adenocarcinoma sequence: prospective pathological implications for early diagnosis of colon cancer. With S. Krishn, et al. *Cancer Letters*, 374 (2), 304-314, 2016.

21. Functional central limit theorem for Brownian particle systems in domains with boundary condition. With Z.-Q. Chen. *Journal of Functional Analysis*. Vol. 269 (12), 3765-3811, 2015.
22. Scaling limits of interacting diffusions in domains. With Z.-Q. Chen. *Frontiers of Mathematics in China*, 9 (4): 717–736, 2014.
23. (Book) Pui Ching invitational mathematics competition 2007-2008 questions and answers. With K-H Chan and K-H Law. Pui Ching Education Centre, 2008.

Preprints

24. Impossibility of phylogeny reconstruction from k-mer counts. With B. Legried and S. Roch. *Annals of Applied Probability*, to appear.
25. On the existence of low-dimensional chaos of tropical cyclone intensity. With W. Cai and C. Kieu, submitted.
26. Three-dimensional shear driven turbulence with Levy noise at the boundary. With A. Pakzad, K. Tawri and R. Temam, submitted.

Funding

- NSF-DMS Award (Proposal ID: 2152103, 2151959): *Stochastic reaction-diffusion equations on metric graphs and spatially-resolved dynamics of virus infection spread*. Role: Lead PI; Total award: USD \$701,222. (USD \$335,666 to PI Fan and USD \$365,556 to co-PI Yin) Duration: June 2022 – May 2025.
- NSF-DMS Award (Proposal ID: 1804492, transferred to 1855417): *Stochastic systems for interacting populations*. Role: Sole PI; Total award: USD \$154,255. Duration: June 2018 – May 2022.
- ONR-TCRI DRI Award (N00014-19-S-B001): *Dynamics and Predictability of Tropical Cyclone Rapid Intensification*. Role: Co-PI; Total award: USD \$590,070. Duration: May 2020 – April 2023.
- Hong Kong Research Grant Council- General Research Fund (GRF11301821): *Stochastic modeling of the spatial transmissions of viruses and defective interfering particles*. Role: Co-Investigator; Total award: HKD \$347,007 (~USD \$44,660). Duration: Jan 2022- Dec 2023.
- NSF Travel Award (USD \$700), Workshop on Math Biology and Nonlinear Analysis (2014)

Awards

- Postdoctoral Scholar Award for Excellence in Mentoring Undergraduates, UNC (2015)
- Academic Excellence Award, Math Department, University of Washington (2009)
- Top Scholar Award, University of Washington (2008-2009)
- Best Teaching Assistant Award, Math Department of HKUST (2004)
- Gold Medalist, 12th Asian Pacific Mathematical Olympiad (2000)

- Hong Kong Team member, 41st International Mathematical Olympiad (2000)

Interdisciplinary research experience

Visiting scholar of John Wakeley at Harvard University, July 2021-Jan 2022.

- Study probability problems in coalescent models and their implications in population genetics, including the concept of “coming down from infinity” and the applicability of high sampling regimes in the estimation of mutation rates in gene genealogy.

Affiliate, Wisconsin Institute for Discovery, spring 2016-present.

- Development of spatial stochastic models for the interactions among virus particles, sub-virus particles, bacteria and host innate immune response.
- Implementation of computational models through collaborations with Center for High Throughput Computing (CHTC).
- Integration of empirical data with mathematical models through statistical analysis.

Research assistantship, University of Washington, spring 2009-spring 2014.

- Development of mathematical models, namely PDE and interacting particle systems, to predict and optimize the amount of electric current generated in a solar cell for an NSF Solar Energy Initiative project.

Invited talks

- (Declined) 9th International Conference on Stochastic Analysis and its Applications (2018, Sep 3-7). Bielefeld, Germany.
- SIAM workshop on Network Science (2018, July 12-13).
- 2018 SIAM annual meeting. Mini-symposium on Stochastic Dynamics on graphs (2018, July 9-13). Oregon Convention Center.
- Probability Seminar. Northwestern University. (2018, May 15)
- AMS Sectional Meeting. Stochastic analysis in infinite dimensions. Ohio State University (2018, March 17-18)
- PIMS Probability summer school. University of British Columbia (2017, June 20)
- AMS Sectional Meeting. Self-similarity and Long-range Dependence in Stochastic Processes. Indiana University Bloomington (2017, April 1-2)
- Probability seminar. Purdue University (2017, Feb 21)
- Probability and mathematical physics Seminar. University of Arizona (2016, Dec 7)
- Probability seminar. University of Illinois at Urbana-Champaign (2016, Nov 29)
- Seminar. City University of Hong Kong (2016, Jan 13)
- Statistics and Probability seminar, Boston University (2015, Feb 12)

- Workshop on Mathematical Biology and Nonlinear Analysis, University of Miami (2014, Dec19-21)
- Probability seminar. University of Kansas (2014, Dec 2)
- Department of Ecology and Evolutionary Biology, Princeton University (2014, April 8)
- Probability seminar. University of British Columbia (2014, Feb 5)
- Academic Seminar for Mathematical Database. Hong Kong University (2009, Dec 27)

Colloquium talks

- University of Florida (2018, Jan 16), New Jersey institute of technology (2017, Dec 15), Purdue University (2017, Dec 4), Indiana University (2017, Dec 1), University of Alabama (2017, Nov 29), Temple University (2017, Nov 27), University of Arizona (2017, Jan 24)

Conferences attended

- Southeastern Probability Conference, Duke University (2017, May 11-12)
- Mathematical and Statistical Ecology, SAMSI (2014, Aug 18-22)
- Seminar on Stochastic Processes, University California San Diego (2014, March 26-29)
- Pacific Northwest Probability Seminar, Co-organized by University of Washington and Microsoft Research. (2008-2013, October)
- 36th Conference on Stochastic Processes and their Applications, University of Colorado Boulder. (2013, July 29 - Aug 2)
- Recent Trends in Stochastic Analysis, University of British Columbia. (2013, July 22-26)

Teaching experience

Instructor

University of Wisconsin-Madison (Fall 2015 - present).

Stochastic analysis (graduate course, Math 735), *Introduction to probability* (Math 431),
Introduction to Stochastic processes (Math 632), *Calculus* (Math 211)

University of North Carolina (Spring 2015 - Summer 2015).

Introduction to decision science (STOR 215), *Introduction to probability* (STOR 435),
Decision models for economics (STOR 113)

University of Washington (Fall 2010 - Spring 2014).

Ordinary Differential Equations (Math 307), *Linear Algebra* (Math 308).

Lingnan Institute of Further Education, Hong Kong (Fall 2006 - Spring 2008).

Applications of Mathematics in Business and Economics

Mentor and thesis adviser for undergraduate research

University of Wisconsin-Madison (Fall 2015 - present)

- Mentor for 8 undergraduate students and 5 masters students. Thesis adviser of 6 students.
- Mentor for two undergraduate students in a Research Experience for Undergraduate (REU) program under an NSF career award to Sebastien Roch

University of North Carolina (Fall 2014 - Summer 2015)

- Mentor for 6 undergraduate students. Thesis adviser of one student.

University of Washington (Summer 2013 - summer 2014)

- Mentor for 2 undergraduate students.

Teaching Assistant

University of Washington (Fall 2008 - Spring 2014)

Courses: *Pre-Calculus* (Math 112), *Calculus* (Math 124, Math 125, Math 126)

Hong Kong University of Science and Technology (Fall 2004 - Spring 2005)

Courses: *Multivariable Calculus* (Math 100), *Differential Equations* (Math 150, 151)

Curriculum designer

Profound Education and Consulting Ltd. (Fall 2005 - Spring 2008).

Professional memberships

- Member, Bernoulli Society (2018-present)
- Member, Institute of Mathematical Statistics (2018-present)
- Member, The Society for the Study of Evolution (2016-present)
- Member, The Society for Mathematical Biology (2016-present)
- Member, American Mathematical Society (2008-present)

Professional service

- Referee for *Annals of Probability*, *Annals of Applied Probability*, *Bernoulli*, *Bulletin of Math Biology*, *Potential Analysis*, *Computers and mathematics with applications*, *Stochastics and dynamics*, *Journal of Computational Biology*, *Journal of Theoretical Biology*, *Latin American Journal of probability and mathematical statistics*.
- Volunteer for the Discovery Volunteer program: facilitate hands-on learning activities and provide information for kids and adults for the Wisconsin community (2018-)
- Organizing committee, UW-Madison Postdoctoral Research Symposium (Sept 22, 2017)
- Co-organizing the Duke-UNC Probability Seminar (Fall 2014 - Spring 2015)

- Pui Ching Invitational Mathematics Competition (2002-2010)
 - Problem poser and organizer, co-editor of solution book
- Mathematical Database, www.mathdb.org (2007-2008)
 - Co-founder and Chairman of a non-profit mathematical platform
 - Creation of notes and teaching modules for resource sharing for communities in mathematical education
- Consultant for Math Concept. Ltd. (2017-)

Additional experience

- Silver Medalist in Freestyle 6, National Competition, Ice Skating Institute of Asia. (2002)
- Gold Medalist in Freestyle 5, Skate Asia. (2001)