Wenqing Hu

CONTACT INFORMATION

112 Rolla Building,
Department of Mathematics and Statistics,
Missouri University of Science and Technology,
(formerly University of Missouri, Rolla)
400W, 12th St., Rolla, MO, 65409–0020, USA.

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RESEARCH AREAS AND TOPICS

I work on problems in *Probablity* and *Applied Mathematics*. Specific topics that I have been working on are summarized below.

• *Probability*: stochastic analysis, small random perturbations of dynamical systems, large deviations, metastability, stochastic averaging principle, reaction-diffusion equations and wave front propagation in random media, stochastic fluid mechanics, turbulence models, small mass limit of the Langevin equation (Smoluchowski-Kramers approximation), homogenization and multiscale problems, system of fast-slow stochastic reaction diffusion equations.

• *Data Sciences/Machine Learning/Optimization*: covariance matrix estimation under High-Dimensional-Low-Sample-Size (HDLSS) setting, with applications to regularized linear discriminant analysis in Electronic Health Records (EHR) data, variational inference of human mobility patterns via Hawkes processes, convergence analysis of stochastic approximation algorithms (e.g. stochastic gradient descent) that are used in solving stochastic optimization problems, real-world applications of Markov Decision Processes (MDP) and Reinforcement Learning, Image Classification and Neural Network structure.

• *Operations Research*: Smart Grid, Energy Management, Reinforcement Learning applied to Intelligent and Digital Manufacturing Systems.

• *Math Biology*: Ao's potential function and its relation with stochastic dynamical systems.

• *Cryptology*: Zero-Knowledge Proofs and their applications to Virtual Machines and Blockchain Layer2 (like Ethereum).

ACADEMIC EMPLOYMENT

Missouri University of Science and Technology. Rolla, Missouri, USA.
(formerly **University of Missouri, Rolla**)

Associate Professor (with tenure), 06/2022 – present.

Assistant Professor (tenure–track), 07/2016 – 05/2022.

University of Minnesota, Twin Cities. Minneapolis, Minnesota, USA.

Postdoctoral Associate, 08/2013 – 06/2016.

Mentor: Professor Vladimír Šverák.

EDUCATION

University of Maryland, College Park. College Park, Maryland, USA.

Ph.D. in Mathematics, 08/2008 – 05/2013.

Dissertation Topic: "Asymptotic Problems in Stochastic Processes and Differential Equations".
Advisor: Professor Mark Freidlin.

Peking University. Beijing, P.R.China.

B.S. in Mathematics, 09/2004 – 07/2008.

Thesis Topic: "From Markov processes to martingales and independent increment processes". Advisor: Professor Yong Liu.

Preprints in Submission / Revision

• Haotian Chen, Wenqing Hu, Siyuan Wang, Rui Bo, Deep Reinforcement Learning Based Arbitrage Strategy Development for Microgrid Energy Storage System Considering Look-Ahead Commitment. Submitted.

• Wenqing Hu, Hong Qian, On the Posterior Distribution of a Random Process Conditioned on Observing the Empirical Frequencies: the i.i.d and finite Markov chain case. Preprint. Submitted.

arXiv:2202.11780 [math.PR]

Journal Publications

• Tianyi Liu, Zhenfei Zhang, Yuncong Zhang, Wenqing Hu, Ye Zhang, *Ceno*: Non-uniform, Segment and Parallel Zero-Knowledge Virtual Machine. *Journal of Cryptology*, **38**, 17 (2025).

DOI: https://doi.org/10.1007/s00145-024-09533-2

• Haoyu Wang, Xiaoliang Gan, Wenqing Hu, Ping Ao, The generalized Lyapunov function as Ao's potential function: Existence in dimensions 1 and 2, *Journal of Applied Analysis and Computation*, Volume **13**, Number 1, February 2023, pp. 359-375.

DOI: 10.11948/20220149

• Haoyu Wang, Xiaoliang Gan, Wenqing Hu, Ping Ao, Fundamental Structure of General Stochastic Dynamical Systems: High-Dimension Case, *Journal of Mathematics*, Volume 2022 Article ID 2596074.

DOI: https://doi.org/10.1155/2022/2596074

• Jiaojiao Yang, Zeyi Sun, Wenqing Hu, Louis Steinmeister, Joint Control of Manufacturing and Onsite Microgrid System via Novel Neural-Network Integrated Reinforcement Learning Algorithms. Volume **315**, 1 June 2022, 118982.

DOI: https://doi.org/10.1016/j.apenergy.2022.118982

• Wai–Tong (Louis) Fan, Wenqing Hu, Grigory Terlov, Wave propagation for reaction–diffusion equations on infinite random trees. *Communications in Mathematical Physics*, **384**, Issue 1, April 2021, pages 109-163.

DOI: 10.1007/s00220-021-04085-z. arXiv:1907.12962[math.PR]

• Md Monirul Islam, Zeyi Sun, Ruwei Qin, Wenqing Hu, Haoyi Xiong, Kaibo Xu, Flexible energy load identification in intelligent manufacturing for demand response using a neural network integrated particle swarm optimization. *Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science*, online first, 2020.

DOI: 10.1177/0954406220933652.

• Jiaojiao Yang, Wenqing Hu, Chris Junchi Li, On the fast convergence of random perturbations of the gradient flow. *Asymptotic Analysis*, Volume 122, 2021, pages 371-393.

DOI 10.3233/ASY-201622. arXiv:1706.00837[math.PR].

• Md Monirul Islam, Xiao Zhong, Zeyi Sun, Haoyi Xiong, Wenqing Hu, Real–Time Frequency Regulation Using Aggregated Electric Vehicles in Smart Grid, *Computers & Industrial Engineering*, Volume 134, August 2019, pages 11-26.

DOI: 10.1016/j.cie.2019.05.025.

• Wenqing Hu, On the long time behavior of a perturbed conservative system with degeneracy. *Journal of Theoretical Probability*, Volume 33, pp.1266-1295, 2020. (Published online on 11, May 2019.).

DOI: 10.1007/s10959-019-00911-2. `arXiv:1808.01510[math.PR]`.

• Wenqing Hu, Michael Salins, Konstantinos Spiliopoulos, Large deviations and averaging for systems of slow–fast stochastic reaction–diffusion equations. *Stochastics and Partial Differential Equations: Analysis and Computations*, December 2019, Volume 7, Issue 4, pp. 808-874.

DOI: 10.1007/s40072-019-00140-y. `arXiv:1710.02618[math.PR]`.

• Wenqing Hu, Chris Junchi Li, Lei Li, Jian-Guo Liu, On the diffusion approximation of nonconvex stochastic gradient descent. *Annals of Mathematical Science and Applications*, Vol. 4, No. 1 (2019), pp. 3–32.

DOI: http://dx.doi.org/10.4310/AMSA.2019.v4.n1.a1. `arXiv:1705.07562v2[stat.ML]`.

• Wenqing Hu, Chris Junchi Li, A convergence analysis of perturbed compositional gradient flow: averaging principle and normal deviations. *Discrete and Continuous Dynamical Systems, Series A*, **38**, 10, October 2018, pp. 4951–4977.

DOI: 10.3934/dcds.2018216. `arXiv:1709.00515[math.PR]`.

• Haoyi Xiong, Wei Cheng, Wenqing Hu, Jiang Bian, Zhishan Guo, DBSDA: Lowering the Error Bound of Linear Discriminant Analysis via De–Biasing. *IEEE Transactions on Neural Networks and Learning Systems*, **30**, 3, pp. 707–717, March 2019.

DOI: 10.1109/TNNLS.2018.2846783.

• Wenqing Hu, Vladimír Šverák, Dynamics of geodesic flows with random forcing on Lie groups with left–invariant metrics. *Journal of Nonlinear Science*. **28**, 6, pp. 2249–2274, December 2018.

DOI: 10.1007/s00332-018-9446-1. `arXiv:1510.05279[math.AP]`.

• Wenqing Hu, Itô's formula, the stochastic exponential and change of measure on general time scales. *Abstract and Applied Analysis*, Vol. 2017, Article ID 9140138, 2017.

DOI: 10.1155/2017/9140138. `arXiv:1609.05967[math.PR]`.

• Wenqing Hu, Konstantinos Spiliopoulos, Hypoelliptic multiscale Langevin diffusions: Large deviations, invariant measures and small mass asymptotics. *Electronic Journal of Probability*, 2017, Vol. 22, article no. 55, pp. 1–38.

DOI: 10.1214/17-EJP72. `arXiv:1506.06181[math.PR]`.

• Tarek Elgindi, Wenqing Hu, Vladimír Šverák, On 2–dimensional incompressible Euler equations with partial damping. *Communications in Mathematical Physics*, **355**, 1, October 2017, pp. 145–

159.

DOI: 10.1007/s00220-017-2877-y. arXiv:1511.02530[math.AP].

• Wenqing Hu, Lucas Tcheuko, Random perturbations of dynamical systems with reflecting boundary and corresponding PDE with a small parameter. *Asymptotic Analysis*, **87**, No. 1–2, 2014, pp. 43–56.

DOI: 10.3233/ASY-131197. arXiv:1203.5092[math.PR].

• Mark Freidlin, Wenqing Hu, Wave front propagation for a reaction-diffusion equation in narrow random channels. *Nonlinearity*, **26**, 8, 2013, pp. 2333–2356.

DOI: 10.1088/0951-7715/26/8/2333. arXiv:1303.6943[math.PR].

• Mark Freidlin, Wenqing Hu, On second order elliptic equations with a small parameter. *Communications in Partial Differential Equations*, **38**, 10, 2013, pp. 1712–1736.

DOI: 10.1080/03605302.2013.812658. arXiv:1203.5096[math.PR].

• Mark Freidlin, Wenqing Hu, On diffusion in narrow random channels. *Journal of Statistical Physics*, **152**, 2013, pp. 136–158.

DOI: 10.1007/s10955-013-0763-3. arXiv:1210.5226[math.PR].

• Wenqing Hu, On metastability in nearly–elastic systems. *Asymptotic Analysis*, **79**, 1–2, 2012, pp. 65–86.

DOI: 10.3233/ASY-2011-1090. arXiv:1202.0577[math.PR].

• Mark Freidlin, Wenqing Hu, Alexander Wentzell, Small mass asymptotic for the motion with vanishing friction. *Stochastic Processes and their Applications*, **123** (2013), pp. 45–75.

DOI: 10.1016/j.spa.2012.08.013. arXiv:1201.1242[math.PR].

• Mark Freidlin, Wenqing Hu, Smoluchowski–Kramers approximation in the case of variable friction. *Journal of Mathematical Sciences*, **79**, 1, November 2011, translated from *Problems in Mathematical Analysis*, **61**, October 2011 (in Russian).

DOI: 10.1007/s10958-011-0589-y. arXiv:1203.0603[math.PR].

• Mark Freidlin, Wenqing Hu, On perturbations of generalized Landau–Lifshitz dynamics. *Journal of Statistical Physics*, **144**, 2011, pp. 978–1008.

DOI: 10.1007/s10955-011-0289-5. arXiv:1203.0602[math.PR].

• Mark Freidlin, Wenqing Hu, On stochasticity in nearly–elastic systems. *Stochastics and Dynamics*, **12**, 3, 2012.

DOI: 10.1142/S0219493711500201. arXiv:1203.5468[math.PR].

Conference Publications

• Wenqing Hu, Tiefeng Jiang, Birendra Kathariya, Vikram Abrol, Jiali Zhang, Zhu Li, Subspace Interpolation and Indexing on Stiefel and Grassmann Manifolds as a Lightweight Inference Engine. *IEEE Big Data 2023 (2023 IEEE International Conference on Big Data), Sorrento, Italy, December*

15-18, 2023. Acceptance Rate: 92/526=17.5%.

• Jingfeng Wu, Wenqing Hu, Haoyi Xiong, Jun Huan, Vladimir Braverman, Zhanxing Zhu, On the Noisy Gradient Descent that Generalizes as SGD. *ICML 2020 (37th International Conference on Machine Learning), virtual conference due to COVID-19, July 12-18, 2020.*

• Huizhuo Yuan, Xiangru Lian, Li, Chris Junchi Li, Ji Liu, Wenqing Hu, Efficient Smooth Non-Convex Stochastic Compositional Optimization via Stochastic Recursive Gradient Descent. *NeurIPS 2019 (Thirty-third Conference on Neural Information Processing Systems), Vancouver, Canada, December 8-14, 2019.*

• Wenqing Hu, Chris Junchi Li, Xiang Zhou, On the Global Convergence of Continuous-Time Stochastic Heavy-Ball Method for Nonconvex Optimization. *IEEE Big Data 2019 (2019 IEEE International Conference on Big Data), Los Angeles, California, USA, December 9-12, 2019.*

DOI: 10.1109/BigData47090.2019.9005621

• Md Monirul Islam, Zeyi Sun, Wenqing Hu, Cihan H Dagli, A Framework of Integrating Manufacturing Plants in Smart Grid Operation: Manufacturing Flexible Load Identification. *ICPR 2019 (the 25th International Conference on Production Research), Chicago, Illinois, USA, August 10-14, 2019.*

DOI: https://doi.org/10.1016/j.promfg.2020.01.346

• Wenqing Hu, Zeyi Sun, Yunchao Zhang, Yu Li, Joint Manufacturing and Onsite Microgrid System Control Using Markov Decision Process and Neural Network Integrated Reinforcement Learning. *ICPR 2019 (the 25th International Conference on Production Research), Chicago, Illinois, USA, August 10-14, 2019.* In press at *Procedia Manufacturing.*

DOI: https://doi.org/10.1016/j.promfg.2020.01.345

• Haoyi Xiong, Wei Cheng, Wenqing Hu, Jiang Bian, Yanjie Fu, Zhishan Guo, De–Biasing Covariance Regularized Fisher's Linear Discriminant Analysis with Faster Asymptotic Rate. *IJCAI–ECAI–18 (The 27th International Joint Conference on Artificial Intelligence and the 23rd European Conference on Artificial Intelligence), Stockholm, Sweden, July 13–19, 2018.*

DOI: https://doi.org/10.24963/ijcai.2018/401

• Jiang Bian, Haoyi Xiong, Wei Cheng, Yanjie Fu, Wenqing Hu, Zhishan Guo, Multi–Party Sparse Discriminant Learning. *ICDM 2017 (2017 IEEE International Conference on Data Mining), New Orleans, Louisiana, USA, November 8–21, 2017.*

DOI: 10.1109/ICDM.2017.86.

• Haoyi Xiong, Wei Cheng, Jiang Bian, Wenqing Hu, Zhishan Guo, AWDA: An Adaptive Wishart Discriminant Analysis. *ICDM 2017 (2017 IEEE International Conference on Data Mining), New Orleans, Louisiana, USA, November 8–21, 2017.*

DOI: 10.1109/ICDM.2017.62.

• Pengfei Wang, Guannan Liu, Yanjie Fu, Wenqing Hu, Charu Aggarwal, Human Mobility Synchronization and Trip Purpose Detection with Mixture of Hawkes Processes. *KDD 2017 (Knowledge, Discovery and Data mining), Halifax, Nova Scotia–Canada, August 13–17, 2017.* Accepted paper ID=fp1019.

DOI: 10.1145/3097983.3098067.

UNPUBLISHED MANUSCRIPT

• Huizhuo Yuan, Wenqing Hu, Stochastic Recursive Momentum Method for Non-Convex Compositional Optimization. Preprint.

arXiv:2006.01688[math.OC]

• Wenqing Hu, Zhanxing Zhu, Haoyi Xiong, Jun Huan, Quasi–potential as an implicit regularizer for the loss function in the stochastic gradient descent. Preprint. Submitted.

arXiv:1901.06054[cs.LG].

AWARDS AND GRANTS

• Simons Foundation Collaboration Grants for Mathematicians, 2020-2025. Amount=$42000.

• Miner Alumni Association's Class of '42 Excellence in Teaching Award. June 20, 2018. Amount=$2000.

• NSF sponsored AMS Travel Support to the International Congress of Mathematicians (ICM) in Rio de Janeiro, Brazil, in August of 2018. Amount=$3300.

• University of Missouri Research Board. June 1, 2017–May 31, 2018. Topic: Multiscale Stochastic Differential Equations. Amount=$5000.

• AMS–Simons Travel Grant. July 1, 2015–June 30, 2017. Amount=$4000.

• Patrick and Marguerite Sung Fellowship in Mathematics. College of Computer, Mathematical and Natural Sciences, University of Maryland, College Park, Spring 2012.

• Block–Grant Graduate Student Fellowship. Department of Mathematics, University of Maryland, College Park, Fall 2008–Spring 2010.

INVITED TALKS/ PRESENTATIONS/ LECTURES

• Conference "Modern Topics in Probability" in honor of Professor Mark Freidlin's 85th birthday.
Department of Mathematics, University of Maryland.
College Park, Maryland, USA. 10/21/2022.

Talk Title: On the Posterior Distribution of a Random Process Conditioned on Empirical Frequencies of a Finite Path: the i.i.d and finite Markov chain case.

• Probability and Statistics Seminar. (online via zoom).
Department of Mathematics, University of Kansas.
Lawrence, Kansas, USA. 05/04/2022.

Talk Title: On the Posterior Distribution of a Random Process Conditioned on Empirical Frequencies of a Finite Path: the i.i.d and finite Markov chain case.

• Probability Seminar. (online via zoom).
Department of Mathematics, University of Washington at Seattle.
Seattle, Washington, USA. 04/11/2022.

Talk Title: On the Posterior Distribution of a Random Process Conditioned on Empirical Frequencies of a Finite Path: the i.i.d and finite Markov chain case.

• AMS Sectional Meeting. (online via zoom).
Recent Developments of Variational Methods in Deterministic and Stochastic Systems for the AMS

Spring Central Sectional Meeting (Mar 26-27, 2022).
Indiana, USA. 03/26/2022.

Talk Title: On the Posterior Distribution of a Random Process Conditioned on Empirical Frequencies of a Finite Path: the i.i.d and finite Markov chain case.

• Probability Seminar.
Beijing International Center of Mathematical Researach (BICMR), Peking University.
Beijing, China. 10/21/2021.

Talk Title: Wave propagation for reaction-diffusion equations on infinite random trees.

• Probability Seminar.
School of Mathematical Sciences, Beijing Normal University.
Beijing, China. 10/18/2021.

Talk Title: Wave propagation for reaction-diffusion equations on infinite random trees.

• Probability Seminar. (online via zoom).
Department of Mathematics, University of Illinois–Urbana Champaign.
Urbana Champaign, Illinois, USA. 04/27/2021.

Talk Title: Wave propagation for reaction-diffusion equations on infinite random trees.

• Stochastics+Data+Computing Seminar (online via zoom).
College of Computing, Department of Applied Mathematics, Illinois Institute of Technology.
Chicago, Illinois, USA. 12/18/2020.

Talk Title: Wave propagation for reaction-diffusion equations on infinite random trees.

• Differential Equation Seminar (online due to COVID-19).
Department of Mathematics, University of Missouri (Mizzou).
Columbia, Missouri, USA. 10/08/2020.

Talk Title: Wave propagation for reaction-diffusion equations on infinite random trees.

• Duke–Kunshan University.
Kunshan, Soochow, China. 07/14/2020–08/13/2020.

Zu–Chongzhi Lectures at Duke–Kunshan University: Introductory Lectures on Machine Learning, Nonlinear Optimization and Reinforcement Learning. Lectures delivered online.

• Analysis Seminar,
Department of Mathematics and Statistics, Missouri University of Science and Technology (formerly University of Missouri, Rolla).
Rolla, Missouri, USA. 10/21/2019.

Talk Title: Wave propagation for reaction-diffusion equations on infinite random trees.

• Department Colloquia,
Department of Statistics, University of Missouri.
Columbia, Missouri, USA. 10/14/2019.

Talk Title: Some Probabilistic Understandings of the Effects of Noise in the Stochastic Gradient

Descent.

• Probability and Related Fields Seminar,
Department of Mathematics, Indiana University Bloomington.
Bloomington, Indiana, USA. 10/07/2019.

Talk Title: Wave propagation for reaction-diffusion equations on infinite random trees.

• Probability Seminar,
Department of Mathematics, University of Maryland, College Park.
College Park, Maryland, USA. 08/30/2019.

Talk Title: Wave propagation for reaction-diffusion equations on infinite random trees.

• Seminar at the School of Data Science,
City University of Hong Kong.
Hong Kong, China. 07/03/2019.

Talk Title: Some Probabilistic Understandings of the Effects of Noise in the Stochastic Gradient Descent.

• Seminar on Pure Mathematics,
Department of Mathematics, The Hong Kong University of Science and Technology.
Hong Kong, China. 07/02/2019.

Talk Title: On 2d incompressible Euler equations with partial damping and some related model problems.

• Seminar of Department of Mathematics,
Department of Mathematics, Universidad de Macau (University of Macau).
Macau, China. 06/27/2019.

Talk Title: Some Probabilistic Understandings of the Effects of Noise in the Stochastic Gradient Descent.

• Invited Lecture Series at the Faculty of Science and Technology.
Department of Mathematics, Universidad de Macau (University of Macau).
Macau, China. 06/24/2019 – 06/26/2019.

Invited Lectures: Lectures on Nonlinear Optimization in Machine Learning. 3 lectures, 2 hours each. Lecture notes are available on my personal webpage.

• Applied Computational Intelligence Laboratory.
Department of Electrical and Computer Engineering, Missouri University of Science and Technology (formerly University of Missouri, Rolla).
Rolla, Missouri, USA. 04/30/2019.

Talk Title: Stochastic Approximations, Diffusion Limit and Small Random Perturbations of Dynamical Systems – a probabilistic approach to machine learning.

• Analysis Seminar.
Department of Mathematics and Statistics, Missouri University of Science and Technology (formerly University of Missouri, Rolla).
Rolla, Missouri, USA. 04/15/2019.

Talk Title: Stochastic Approximations, Diffusion Limit and Small Random Perturbations of Dynamical Systems – a probabilistic approach to machine learning.

• Analysis Seminar.
Department of Mathematics and Statistics, Missouri University of Science and Technology (formerly University of Missouri, Rolla).
Rolla, Missouri, USA. 03/18/2019.

Talk Title: On 2d incompressible Euler equations with partial damping and some related model problems.

• Department Colloquium.
Department of Mathematics, Louisiana State University.
Baton Rouge, Louisiana, USA. 01/25/2019.

Talk Title: Stochastic Approximations, Diffusion Limit and Small Random Perturbations of Dynamical Systems – a probabilistic approach to machine learning.

• Duke–Kunshan University.
Kunshan, Soochow, China. 01/08/2019.

Talk Title: Stochastic Approximations, Diffusion Limit and Small Random Perturbations of Dynamical Systems.

• PDE Seminar.
Department of Mathematics, Vanderbilt University.
Nashville, Tennessee, USA. 11/16/2018.

Talk Title: On 2d incompressible Euler equations with partial damping and some related model problems.

• The 4th Annual Meeting of SIAM Central States Session.
University of Oklahoma.
Norman, Oklahoma, USA. 10/06/2018.

Talk Title: On the long–time behavior of a perturbed conservative system with degeneracy.

• 2018 Anhui Normal University Summer Lecture Series.
School of Mathematics and Statistics, Anhui Normal University.
Wuhu, Anhui, China. 06/27/2018 – 07/08/2018.

Invited Lectures: Lectures on Nonlinear Optimization in Machine Learning. 4 lectures, 2 hours each. Lecture notes are available on my personal webpage.

• PDE Seminar.
School of Mathematics and Statistics, Huazhong University of Science and Technology.
Wuhan, Hubei, China. 06/23/2018.

Talk Title: A random perturbation approach to some stochastic approximation algorithms in optimization.

• Stochastic Analysis Seminar.
College of Mathematics, Sichuan University.
Chengdu, Sichuan, China. 06/22/2018.

Talk Title: A random perturbation approach to some stochastic approximation algorithms in optimization.

• Information and Software Engineering Academic Forum.
Department of Computer Science, University of Electronic Science and Technology of China.
Chengdu, Sichuan, China. 06/21/2018.

Talk Title: A random perturbation approach to some stochastic approximation algorithms in optimization.

• Randomized Numerical Linear Algebra Seminar.
College of Mathematics and Statistics, Chongqing University.
Chongqing, China. 06/19/2018.

Talk Title: A random perturbation approach to some stochastic approximation algorithms in optimization.

• Probability Seminar.
School of Mathematical Sciences, Beijing Normal University.
Beijing, China. 06/12/2018.

Talk Title: Hypoelliptic multiscale Langevin diffusions and slow–fast stochastic reaction diffusion equations.

• Probability Seminar.
School of Mathematical Sciences, Peking University.
Beijing, China. 06/11/2018.

Talk Title: A random perturbation approach to some stochastic approximation algorithms in optimization.

• Invited Lecture "Scientific Frontiers of the 21st Century",
Beijing Institute of Technology, Beijing, China. 06/08/2018.

Talk Title: A random perturbation approach to some stochastic approximation algorithms in optimization.

• Baidu Big Data Lab in Beijing, Baidu, Inc. Beijing, China. 06/07/2018.

Talk Title: A random perturbation approach to some stochastic approximation algorithms in optimization.

• Stochastic Analysis Seminar.
School of Mathematical Sciences, Peking University.
Beijing, China. 06/05/2018.

Talk Title: On 2–d incompressible Euler equations with partial damping.

• Shanghai Center for Quantitative Life Sciences. Shanghai University.
Shanghai, China. 05/27/2018.

Talk Title: A random perturbation approach to some stochastic approximation algorithms in optimization.

• Probability Seminar.
Department of Mathematics, University of Wisconsin–Madison.
Madison, Wisconsin, USA. 03/15/2018.

Talk Title: A random perturbation approach to some stochastic approximation algorithms in optimization.

• Analysis Seminar.
Department of Mathematics and Statistics, Missouri University of Science and Technology (formerly University of Missouri, Rolla).
Rolla, Missouri, USA. 03/12/2017.

Talk Title: A random perturbation approach to some stochastic approximation algorithms in optimization.

• Analysis Seminar.
Department of Mathematics and Statistics, Missouri University of Science and Technology (formerly University of Missouri, Rolla).
Rolla, Missouri, USA. 12/04/2017.

Talk Title: Large deviations and averaging for systems of slow–fast stochastic reaction–diffusion equations.

• Differential Equation Seminar.
Department of Mathematics, University of Missouri (Mizzou).
Columbia, Missouri, USA. 11/02/2017.

Talk Title: On the fast convergence of random perturbations of the gradient flow.

• Analysis Seminar.
Department of Mathematics and Statistics, Missouri University of Science and Technology (formerly University of Missouri, Rolla).
Rolla, Missouri, USA. 09/25/2017.

Talk Title: On the fast convergence of random perturbations of the gradient flow.

• Probability Seminar.
Department of Mathematics, University of Illinois–Urbana Champaign.
Urbana Champaign, Illinois, USA. 09/12/2017.

Talk Title: On the fast convergence of random perturbations of the gradient flow.

• Department of Computer Science, Missouri University of Science and Technology (formerly University of Missouri, Rolla).
Rolla, Missouri, USA. Spring 2017.

Invited Lectures: Lectures on the Nature of Statistical Learning Theory. 5 lectures, 1 hour each. Lecture notes are available on my personal webpage.

• Mathematical Association of America–Missouri S&T Chapter.
Missouri University of Science and Technology (formerly University of Missouri, Rolla).
Rolla, Missouri, USA. 12/01/2016.

Talk title: From Brownian motion to stochastic calculus, and beyond.

• Kappa Mu Epsilon National Mathematics Honor Society S&T Chapter.
Missouri University of Science and Technology (formerly University of Missouri, Rolla).
Rolla, Missouri, USA. 10/12/2016.

Talk title: From Brownian motion to stochastic calculus, and beyond.

• Time Scales Seminar.
Department of Mathematics and Statistics, Missouri University of Science and Technology (formerly University of Missouri, Rolla).
Rolla, Missouri, USA. 10/05/2016.

Talk title: Itô's formula, the stochastic exponential and change of measure on general time scales.

• The 2nd Annual Meeting of SIAM Central States Section.
University of Arkansas at Little Rock.
Little Rock, Arkansas, USA. 10/01/2016.

Talk title: On 2–d incompressible Euler equations with partial damping.

• Computational and Applied Mathematical Sciences Seminar.
Department of Mathematics and Statistics, Missouri University of Science and Technology (formerly University of Missouri, Rolla).
Rolla, Missouri, USA. 09/27/2016.

Talk title: Hypoelliptic multiscale Langevin diffusions: Large deviations, invariant measures and small mass asymptotics.

• Stochastics Seminar.
School of Mathematics, Georgia Institute of Technology.
Atlanta, Georgia, USA. 04/07/2016.

Talk title: Dynamics of geodesic flows with random forcing on Lie groups with left–invariant metrics.

• Department Colloquium.
Department of Mathematics and Statistics, Missouri University of Science and Technology (formerly University of Missouri, Rolla).
Rolla, Missouri, USA. 02/19/2016.

Talk title: Stochastically Perturbed Geodesic Flows on Lie Groups.

• Probability Seminar.
School of Mathematics, University of Minnesota, Twin Cities.
Minneapolis, Minnesota, USA. 01/29/2016.

Talk title: Dynamics of geodesic flows with random forcing on Lie groups with left–invariant metrics.

• 2015 Peking University Youth Probability Forum.
Peking University, Beijing, China. 07/09/2015 – 07/17/2015.

Invited Lectures: Lectures on Stochastic Fluid Mechanics. 5 lectures, 2 hours each. Lecture notes are available on my personal webpage.

• 2015 Peking University Youth Probability Forum.
Peking University, Beijing, China. 07/08/2015.

Talk title: Random motion along co–adjoint orbits.

• AMS 2015 Spring Sectional Meeting.
Georgetown University. Special Session on Asymptotic Problems for Stochastic Processes and PDEs.
Washington D.C., USA. 03/08/2015.

Talk title: Random motion along co–adjoint orbits.

• Cincinnati Symposium on Probability Theory and Applications.
Department of Mathematical Sciences, University of Cincinnati.
Cincinnati, Ohio, USA. 09/20/2014.

Poster Presentation: Second order elliptic equations with a small parameter.

• Workshop "Recent Advances in PDEs and Fluids".
Department of Mathematics, Stanford University.
Palo Alto, California, USA. 08/17/2013.

Talk title: On diffusion and wave front propagation in narrow random channels.

• The 9th Cornell Probability Summer School.
Department of Mathematics, Cornell University.
Ithaca, New York, USA. 07/25/2013.

Talk title: On diffusion and wave front propagation in narrow random channels.

• Conference on Asymptotic Problems in Stochastic Processes and PDEs in honor of Professor Freidlin's birthday.
Department of Mathematics, University of Maryland, College Park.
College Park, Maryland, USA. 05/21/2013.

Talk title: On diffusion and wave front propagation in narrow random channels.

• PDE Seminar.
School of Mathematics, University of Minnesota, Twin Cities.
Minneapolis, Minnesota, USA. 12/12/2012.

Talk title: Second order elliptic equations with a small parameter.

• Applied PDE Research Interaction Team.
Department of Mathematics, University of Maryland, College Park.
College Park, Maryland, USA. 12/03/2012.

Talk title: Second order elliptic equations with a small parameter.

• The 8th Cornell Probability Summer School.
Department of Mathematics, Cornell University.
Ithaca, New York, USA. 07/26/2012.

Talk title: Small mass asymptotic for the motion with variable and vanishing friction.

• Organizing the Student Probability Seminar.
Department of Mathematics, University of Maryland, College Park.
College Park, Maryland, USA. Summer 2012.

Giving series of talks on stochastic partial differential equations.

• Organizing the Student Probability/Combinatorics Seminar.
Department of Mathematics, University of Maryland, College Park.
College Park, Maryland, USA. Fall 2011, Spring 2012.

Giving series of talks: Basic theory; The second moment method (I), (II), (III); The local lemma (I), (II), (III); Martingales and tight concentration (I), (II), (III).

• Student Analysis/PDE/Probability Seminar.
Department of Mathematics, University of Maryland, College Park.
College Park, Maryland, USA. 12/08/2010.

Talk title: An introduction to Schramm–Löwner evolutions.

• Student Analysis/PDE/Probability Seminar.
Department of Mathematics, University of Maryland, College Park.
College Park, Maryland, USA. 03/24/2010.

Talk title: Probabilistic approach to some PDE problems.

Academic Service/ Membership

• I serve as a reviewer of *Mathematical Reviews* (MathSciNet, Reviewer Number: 092509).

• I served as referee for the following journals: *Nonlinearity*, *Transactions of the American Mathematical Society*, *Discrete and Continuous Dynamical Systems–Series A* (3 times), *Journal of Nonlinear Science*, *Stochastic Processes and their Applications* (3 times), *Journal of Differential Equations* (4 times), *Punjab University Journal of Mathematics*, *Journal of Theoretical Probability* (3 times), *Journal of Mathematics and Statistics*, *Acta Mathematica Scientia*, *IEEE Transactions on Parallel and Distributed Systems*, *IEEE Transactions on Image Processing* (3 times), *Asymptotic Analysis*, *SIAM Journal on Mathematical Analysis*, *Annals of Applied Probability* (3 times), *Stochastics and Partial Differential Equations: Analysis and Computations*, *Potential Analysis*, *Applied Probability Journals*.

• I served as reviewer for the following conferences: *Neural Information and Processing Systems, 2019/2022-2024*, *International Conference on Learning Representation, 2020/2021/2024*, *International Conference on Machine Learning, 2022-2024*, *The AAAI conference on Artificial Intelligence, 2019/2025*, *IEEE Big Data Conference, 2019/2023/2024*, *International Conference on Image Processing, 2022*.

• I served as the Program Committee Vice Chair for *IEEE Big Data Conference in 2019* in charge of the Big Data Science and Foundations area.

• I served as the Program Committee Member for *AAAI 2021 (35th AAAI Conference on Artificial Intelligence)*, *IEEE-BigData 2023*, *AAAI 2025*.

• I served as an External Reviewer for *Canada Research Chair* position in 01/2023.

Teaching

• Courses Taught at Missouri University of Science and Technology (formerly University of Missouri, Rolla): Linear Algebra, Elementary Differential Equations, Partial Differential Equations, Nonlinear Optimization in Machine Learning, Introduction to Complex Variables.

• Courses Taught at University of Minnesota, Twin Cities: Applied Linear Algebra, Introduction to Stochastic Processes, Basic Theory of Probability and Statistics, Advanced Calculus I.

• Courses involved as either Teaching Assistant or Grader or Tutor at University of Maryland, College Park: Calculus I-III, Real Analysis, Linear Algebra, Linear Algebra for Scientists and Engineers, Advanced Calculus I-II, Probability, PDE for Scientists and Engineers , Complex Analysis for Scientists and Engineers , Introduction to Numerical Analysis, Abstract Algebra.

Graduate Advising

I am advising the following students at Missouri University of Science and Technology (formerly University of Missouri, Rolla):

• Zhang, Jiali. PhD, 2022–now, currently working with me on image processing, reinforcement learning and advanced manufacturing.

I have advised the following students at Missouri University of Science and Technology (formerly University of Missouri, Rolla):

• O'Conner, Paul K., Master's degree. Thesis: Cryptographic Algorithms, Cryptocurrencies, and a predictive model of bitcoin value by PLS regression. Graduation Date: May 2024.

• Steimeister, Louis K., PhD, 2019–2020, has been working with me on reinforcement learning and advanced manufacturing. Now at TU Dortmund in Germany for a second PhD.

• Vandergriffe, Austin., Master's degree. Graduation Date: August 2021.

I also served as a member of the PhD/Master's thesis defense committee for various doctoral students at Missouri University of Science and Technology (formerly University of Missouri, Rolla).

Undergraduate Advising

I advised the following students on their senior projects – typically an expository paper on a subject chosen by the student.

At Missouri University of Science and Technology (formerly University of Missouri, Rolla):

• Spring 2018. MATH 3304H–1L. Elementary Differential Equations–Honors Program. Term Paper Title: Lotka–Volterra models of Predator–Prey Relationships. Student: Tyler Blaszak, ID=12539004.

At University of Minnesota, Twin Cities:

• Spring 2016. Senior project for independent study (MATH 4997W). Adviser for Wu, Zhouman and Li, Weiqian. Topic: VaR (Value at Risk) estimation and extreme value theory.

• Spring 2016. Senior project for independent study (MATH 4995). Advisor for Yang, Wenjing. Topic: An overview of linear model selection methods.

• Fall 2015. Senior project for independent study (MATH 4997W). Adviser for Xu, Yitong and Sun, Xi. Topic: A review of the Capital Asset Pricing Model.

• Fall 2013. Senior project for independent study (MATH 4997W). Adviser for Lin, Htet Naing and Htet, Maung Soe. Topic: A review of the theory of Markov chains.

I supervised the following undergraduate teams participating the Mathematical Contest in Modeling (MCM).

At University of Minnesota, Twin Cities:

• MCM 2016. Team number: 42730. Team members: Hou, Yucheng; Zhu, Xiaoyi; Song, Qixin. Topic: An ODE model for the temperature dynamics of bathtub system with a person sitting in – the evolution of temperature for different configurations and feedback control mechanism. Result: Honorable Mention.

• MCM 2015. Team number: 42027. Team members: Liu, Jiaoyue; Wang, Xiaoqing; Teng, Da. Topic: The model based on SEIR for Ebola.

Department/ University Service

• Department Committee, Department of Mathematics and Statistics, Missouri University of Science and Technology (formerly University of Missouri, Rolla): Department Policy Committee, 09/2017–12/2019. Department Website Committee, 08/2019–now. Department Graduate Admissions Committee, 01/2021–08/2022. Department Data Sciences Program Committee, 09/2021–now. Department NTT Promotion Committee, 10/2022–now. Department Colloquium Chair, 02/2023–now.

• Campus Faculty Senate, Missouri University of Science and Technology (formerly University of Missouri, Rolla), 09/2022-now.

• Associate Investigator, Intelligent Systems Center (ISC), Missouri S&T, 07/2020–now.

Industrial Experience

• Consulting work on cryptographic zero-knowledge proofs of Ethereum Virtual Machines (EVM) at Scroll Tech during 2023-2024: Scroll is the leading zero-knowledge rollup. Scaling Ethereum for good. See `https://scroll.io/`

Professional Skills/ Certifications

• Programming Language: C/C++, Python, Java, Rust, MATLAB, mySQL, R.

• Operating System: Windows 10, Linux (Ubuntu 22.04), xv6.

• Professional Certificate: Society of Actuaries (SOA) Exams (P=Probability, Taken September 2015, Status=Pass; FM=Financial Mathematics, Taken June 2016, Status=Pass).

• Language: English (Proficient), Chinese (Native).

Last updated: March 26, 2025.