Chang-Han Rhee

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	2145 Sheridan Road, Office C150	chang-han.rhee@northwestern.edu
	Evanston, IL 60208	http://chrhee.github.io

RESEARCH INTERESTS	Probability, Stochastic Simulation, Experimental Design, Machine Learning Theory

ACADEMIC POSITIONS		
	Northwestern University, Evanston, IL, USA	2018–Present
	Industrial Engineering and Management Sciences	
	Assistant Professor	
	Centrum Wiskunde & Informatica, Amsterdam, Netherlands	2015–2018
	Stochastics Group	
	Postdoctoral Researcher	
	Supervisor: Bert Zwart	
	Georgia Institute of Technology, Atlanta, GA, USA	2013–2015
	Industrial & Systems Engineering and Biomedical Engineering	
	Postdoctoral Fellow	
	Supervisor: Enlu Zhou, Peng Qiu	

EDUCATION		
	Stanford University, Stanford, CA, USA	2013
	Ph.D. in Computational and Mathematical Engineering	
	Supervisor: Peter W. Glynn	
	Thesis title: *Unbiased Estimation with Biased Samplers*	
	Stanford University, Stanford, CA, USA	2008
	M.S. in Computational and Mathematical Engineering [1]	
	Seoul National University, Seoul, Korea	2006
	B.S. in Mathematics and B.S. in Computer Science	

RECOGNITIONS	
	• INFORMS George E. Nicholson Student Paper Prize 2nd Place (as supervisor), 2023
	• INFORMS Simulation Society Outstanding Publication Award, 2016
	• INFORMS George E. Nicholson Student Paper Prize Finalist, 2013
	• Winter Simulation Conference Best Student Paper Award (MS/OR), 2012
	• Samsung Fellowship, 2008–2012

GRANTS	
	• NSF CAREER Award
	Catastrophic rare events: theory of heavy tails and applications.
	Amount: $568,493. Duration: 2022–2027. Role: PI.
	• Moloco Inc.
	Stochastic gradient descent in large-scale distributed system.
	Amount: $76,156. Duration: 2022–2023. Role: PI.
	• Northwestern McCormick Catalyst Fund
	Provably efficient reinforcement learning in the face of rare event.
	Amount: $96,320. Duration: 2021–2022. Role: PI with Zhaoran Wang.

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[1]Officially granted in 2013

- South Korean Brain Pool Program (Hosted by Insuk Seo at Seoul National University)
  Analysis of heavy-tailed stochastic gradient descent in artificial intelligence.
  Amount: $69,114 (94.5M KRW).   Duration: 2021–2025.   Role: Invited Scientist.

JOURNAL
PAPERS

[1] "Sample-path large deviations for unbounded additive functionals of the reflected random walk," with M. Bazhba*, J. Blanchet, B. Zwart. To Appear in *Mathematics of Operations Research.* `arXiv:2003.14381`.

[2] "Sample-path large deviations for a class of heavy-tailed Markov additive processes," with B. Chen* and B. Zwart. *Electronic Journal of Probability.* 29: 1–44, 2024.

[3] "Lyapunov conditions for differentiability of Markov chain expectations," with P. W. Glynn. *Mathematics of Operations Research.* 48(4): 2019–2042, 2022.

[4] "Large deviations for stochastic fluid networks with Weibullian tails," with M. Bazhba* and B. Zwart. *Queueing Systems (Special Issue in Honor of Masakiyo Miyazawa).* 102(1–2): 25–52, 2022.

[5] "Sample-path large deviations for Lèvy processes and random walks with Weibull increments," with M. Bazhba*, J. Blanchet, and B. Zwart. *Annals of Applied Probability.* 30(6): 2695–2739, 2020.

[6] "Sample-path large deviations for Lévy processes and random walks with regularly varying increments," with J. Blanchet and B. Zwart. *Annals of Probability.* 47(6): 3551–3605, 2019.

[7] "Efficient rare-event simulation for multiple jump events in regularly varying random walks and compound Poisson processes," with B. Chen*, J. Blanchet, and B. Zwart. *Mathematics of Operations Research.* 44(3): 919–942, 2019.

[8] "Queue length asymptotics for the multiple server queue with heavy-tailed Weibull service times," with M. Bazhba*, J. Blanchet, and B. Zwart. *Queueing Systems.* 93(3–4): 195–226, 2019

[9] "Importance sampling of heavy-tailed iterated random functions," with B. Chen* and B. Zwart. *Advances in Applied Probability.* 50(3): 805–832, 2018.

[10] "Unbiased estimation with square root convergence for SDE models," with P. W. Glynn. *Operations Research*, 63(5): 1026–1043, 2015. **2016 INFORMS Simulation Society Outstanding Simulation Publication Award.** The preprint of this paper was also recognized as a **Finalist for the 2013 INFORMS George E. Nicholson Student Paper Prize.**

[11] "Exact estimation for Markov chain equilibrium expectations," with P. W. Glynn. *Journal of Applied Probability (Special Jubilee Issue)*, 51A: 377–389, 2014.

SUBMITTED
PAPERS

[12] "Space filling design for non-linear models," with E. Zhou and P. Qiu. `arXiv:1710.11616`. Under minor revision after the 2nd round review for *Stochastic Systems.*

[13] "Large deviations and metastability analysis for heavy-tailed dynamical systems," with X. Wang*. `arXiv:2307.03479`. Submitted to *Annals of Probability.* The preprint of this paper was recognized with **the 2023 INFORMS George E. Nicholson Student Paper Prize 2nd Place.**

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* Denotes PhD students under my supervision.

[14] "Strongly efficient rare-event simulation for regularly varying Levy processes with infinite activities," with X. Wang*. `arXiv:2309.13820`. Submitted to *Mathematics of Operations Research*.

CONFERENCE
PROCEEDINGS

[15] "Advanced Tutorial: Importance sampling strategy for heavy-tailed systems with catastrophe principle," with X. Wang*. *Proceedings of the 2023 Winter Simulation Conference*, 2023.

[16] "Eliminating sharp minima from SGD with truncated heavy-tailed noise," with X. Wang* and S. Oh. *International Conference on Learning Representations*, 2022. **IEMS Nemhauser Best Student Paper Prize.**

[17] "Rare-event simulation for multiple jump events in heavy-tailed Lévy processes with infinite activities," with X. Wang*. *Proceedings of the 2020 Winter Simulation Conference*, 2020.

[18] "An iterative algorithm for sampling from manifolds," with E. Zhou and P. Qiu. *Proceedings of the 2014 Winter Simulation Conference*, 2014.

[19] "A new approach to unbiased estimation for SDEs," with P. W. Glynn. *Proceedings of the 2012 Winter Simulation Conference*, 2012. **WSC Best Student Paper (MS/OR).**

WORK
IN PROGRESS

[20] "Global dynamics of heavy-tailed SGDs in non-convex loss landscape: characterization and control," with X. Wang*. To be submitted to *Management Science*.

[21] "Sample-path large deviations for Levy processes and random walks with lognormal increments," with Z. Su*. To be submitted to *Electronic Journal of Probability*.

[22] "Exit time analysis for multiplicative stochastic dynamical systems," with J. Ryu and I. Seo. To be submitted to *Probability Theory and Related Fields*.

[23] "Unbiased derivative estimation for stationary mean of parameterized Markov chains," with J. Wang*. To be submitted to *Stochastic Systems*.

[24] On tail asymptotics for stationary distributions of heavy-tailed processes with X. Wang*.

[25] On queue length asymptotics for queueing systems with lognormal service times with Z. Su*.

[26] On large deviations for processes with multivariate hidden regular variation with Z. Su*.

[27] On efficient gradient estimation for average reward reinforcement learning with J. Wang*.

[28] On rare event simulation for electric power distribution networks with high variability with N. Vasmel and B. Zwart.

[29] On quasi-variational problems in heavy-tailed large deviations theory with B. Zwart and J. Blanchet.

[30] On Lyapunov conditions for differentiability of Markov chain expectations: the contracting case with P. W. Glynn.

STUDENT
MENTORING

PhD Students:
- Bohan Chen (CWI Stochastics[2], 2019); first position: Munich Re
- Mihail Bazhba (CWI Stochastics[2], 2021); first position: Univ. Amsterdam
- Xingyu Wang (Northwestern IEMS, 2024): first position: Univ. Amsterdam
- Zhe Su (Northwestern IEMS): expected to defend in December 2024

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[2]co-supervised (co-promotor in dutch terminology) with Bert Zwart.

- Jeffrey Wang (Northwestern IEMS): expected to defend in 2025
- Jingting Gao (Northwestern ESAM): expected to defend in 2026

MS Students:
- Jingyi Zhao (Northwestern ESAM, 2020)

SERVICES

Award Committee:
- 2023 Winter Simulation Conference Best Poster Award Committee
- 2022–2023 Applied Probability Society Best Student Paper Prize Committee
- 2021–2023 Winter Simulation Conference Diversity Award Committee
- 2019–2022 Winter Simulation Conference PhD Colloquium Committee
- 2020–2021 George Nicholson Prize Committee

Program Committee:
- 2026 Samos Conference (Actuarial and Financial Data Analytics Section Chair)
- 2024 Samos Conference of Actuarial Science and Finance
- 2024 Winter Simulation Conference (Introductory Tutorial Track Chair)
- 2023 IFIP Performance
- 2023 Winter Simulation Conference (Introductory Tutorial Track Chair)
- 2019 Applied Probability Society Conference
- 2019 Monte Carlo Methods
- 2016, 2018, 2019 Winter Simulation Conference

Organizing Committee:
- 2025 Monte Carlo Methods and Applications
- 2023–2024 SNAPP Seminar Series (Chair)
- 2022–2023 SNAPP Seminar Series

Editorial Service:
- Associate Editor, *INFORMS Journal on Computing*, 2019–2022

Referee:
Annals of Applied Probability, Operations Research, Annals of Statistics, Mathematics of Operations Research, Management Science, Electronic Journal of Probability, Stochastic Systems, Bernoulli, Advances in Applied Probability, INFORMS Journal on Computing, IIE Transactions on Automatic Control, Journal of Simulation, Proceedings of the Winter Simulation Conference, Proceedings of the 2016 MCQMC, International Conference on Machine Learning ACM Transactions on Modeling and Computer Simulation IMA Journal

INVITED TALKS

Lecture Series and Seminar Series
- INI Satellite Programme on Heavy Tails in Machine Learning, London, April 2024
- SNAPP Seminar Series, February 2022
- Mark Kac Lecture, Utrecht, November 2017

Tutorials
- WSC Advanced Tutorial, San Antonio, December 2023
- I-SIM Workshop Simulation Summer School Tutorial, State College, June 2021

Keynotes
- KSEA National Mathematics & Science Competition Award Ceremony, December 2020
- International Workshop on Stress Test and Risk Management, Paris, May 2019

Departmental Seminars

- Machine Learning and Data Science Seminar, Oxford, April 2024
- Math Colloquium, University at Albany, March 2024
- Physics and Astronomy Department, Northwestern University, February 2024
- Actuarial Mathematics & Statistics Department, Heriot-Watt, July 2023
- Statistics Department, Warwick, June 2023
- Operations/Management Sciences Department, Chicago Booth, April 2023
- CSL SINE Seminar, UIUC, March 2023
- IBM Research, December 2022
- ISE Department, University of Washington, May 2022
- Math Colloquium, Seoul National University, September 2021
- Center for Science of Science & Innovation, Northwestern University, May 2021
- Center for Financial Mathematics and Actuarial Research, UCSF, April 2021
- Applied Math Colloquium, Illinois Institute of Technology, March 2019
- ISysE Department, KAIST, Daejeon, August 2018
- Stochastics Colloquium, Eindhoven University of Technology, May 2018
- IEOR Department, UC Berkeley, March 2018
- ORIE Program, UT Austin, February 2018
- ISEM Department, National University of Singapore, February 2018
- IEMS Department, Northwestern Univeristy, February 2018
- ORIE Department, Cornell University, April 2017
- Operations Research Seminar, Tinbergen Institute, December 2016
- Computational Statistics Seminar, Oxford University, November 2016
- IBM Watson, September 2016
- Applied Math Department, Ecole Polytechnique, Paris, June 2016
- Queueing Colloquium, Centrum Wiskunde & Informatica, May 2016
- OR Department, Naval Postgraduate School, August 2015
- ISysE Department, Korean Advanced Institute of Sceince and Technology, March 2015
- IME Department, Pohang University of Science and Technology, February 2015
- ISE Department, UIUC, February 2015
- IE Department, Seoul National University, December 2014
- IME Department, Pohang University of Science and Technology, December 2014
- SME Department, Sungkyunkwan University, December 2014
- ISE Department, Virginia Tech, March 2014
- ISysE Department, KAIST, December 2013
- ICME Colloquium, Stanford University, February 2013
- SIAM Seminars in Engineering & Applied Math, Stanford Univsersity, March 2012

Workshops

- I-SIM Workshop, HKUST, June 2024
- The 7th Workshop on Simulation Analytics, Beijing, June 2024

- International Workshop on Applied Probability, Thessaloniki, June 2023
- I-SIM Workshop, State College, June 2021
- Heavy Tails Workshop, Eindhoven, December 2019
- RESIM 2018, Stockholm, August 2018
- Retrospective Monte Carlo Workshop, University of Warwick, July 2016

Teaching

Northwestern University, Evanston, IL, USA

Instructor
- IEMS 435: Stochastic Simulation (2018S, 2020W, 2021S, 2022S, 2023S, 2024S)
- IEMS 315: Stochastic Models (2019W, 2020S/F, 2021S, 2022S/F, 2023S/F, 2024S)

Stanford University, Stanford, CA, USA

Instructor
- CME 001: Math Refresher Course (2011SU)

Teaching Assistant
- CME 100: Vector Calculus (2012F)
- MS&E 322: Stochastic Calculus and Control (2012SP)
- MS&E 121: Introduction to Stochastic Modeling (2007W)