Yunsoo Ha

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Academic Positions

- **Cornell University** *Appointed, starting Oct. 2025*
  Postdoctoral Researcher in the School of Civil and Environmental Engineering USA
  - Research focus: simulation optimization for stochastic game-theoretic models (applications in natural hazard insurance and municipal land use risk management)

- **National Renewable Energy Laboratory** *2024 - Present*
  Postdoctoral Researcher in the Computational Science Center USA
  - Research focus: multi-fidelity stochastic optimization (application to traffic signal control), differentiable optimization, second-order optimizers for deep learning.

Education

- **Ph.D. in Industrial and Systems Engineering** *2018 - 2024*
  North Carolina State University USA
  - Advisor: Sara Shashaani
  - Committee: Yunan Liu, Reha Uzsoy, Quoc Tran-Dinh, Naihuan Jing
  - Dissertation: Expediting Stochastic Derivative Free Optimization
  - *ISE Distinguished Dissertation Award of the 2024 CA Anderson Awards*
  - *Second Place Winner of the 2025 Pritsker Doctoral Dissertation Award by IISE*

- **Master of Operations Research** *2018 - 2021*
  North Carolina State University USA

- **M.S. in Logistics, School of Air Transport, Transportation, and Logistics** *2015 – 2017*
  Korea Aerospace University South Korea

- **B.S. in Logistics, School of Air Transport, Transportation, and Logistics** *2010 – 2015*
  Korea Aerospace University South Korea

Research Interest

Stochastic Optimization, Stochastic Simulation, Monte Carlo Methods, Decision-Focused Learning, Quantum Computing.

Publications

W=Working, C=Conference, J=Journal

[W.1] **Scalable Traffic Signal Control for Urban Mobility: A Subspace-Based Optimization Approach Using Deep Reinforcement Learning.**
Yunsoo Ha, Hyunwoo Shin, Juliane Mueller.

[W.2] **Regularized Adaptive Sampling Trust Region Methods for Stochastic Nonconvex Optimization.**
Yunsoo Ha, Sara Shashaani, Quoc Tran-Dinh.

[J.1] **Adaptive Sampling Bi-Fidelity Stochastic Trust Region Method for Derivative-Free Stochastic Optimization**.
Yunsoo Ha, Juliane Mueller.
Under seccond review at *Mathematical Programming Computation* (submitted 2024).

[J.2] **Complexity of Zeroth-and First-Order Stochastic Trust-Region Algorithms**.
Yunsoo Ha, Raghu Pasupathy, Sara Shashaani.
SIAM Journal on Optimization (2025).

[J.3] **Two-Stage Estimation and Variance Modeling for Latency-Constrained Variational Quantum Algorithms**.
Yunsoo Ha, Sara Shashaani, Matt Menickelly.
INFORMS Journal on Computing (2025).

[J.4] **Iteration Complexity and Finite-Time Efficiency of Adaptive Sampling Trust-Region Methods for Stochastic Derivative-Free Optimization**.
Yunsoo Ha, Sara Shashaani.
IISE Transactions (2025).

[J.5] **Latency Considerations for Stochastic Optimizers in Variational Quantum Algorithms**.
Matt Menickelly, **Yunsoo Ha**, Matthew Otten.
Quantum (2023).

[J.6] **A Decision Model to Determine the Number of Shuttles in a Tier-to-Tier SBS/RS**.
Yunsoo Ha, Junjae Chae.
International Journal of Production Research (2019).

[J.7] **Free Balancing for a Shuttle-Based Storage and Retrieval System**.
Yunsoo Ha, Junjae Chae.
Simulation Modelling Practice and Theory (2018).

[C.1] **Multi-Fidelity Stochastic Trust Region Method with Adaptive Sampling**
Yunsoo Ha, Juliane Mueller.
Accepted at *Winter Simulation Conference 2025*.

[C.2] **Towards Greener Stochastic Derivative-Free Optimization with Trust Regions and Adaptive Sampling**.
Yunsoo Ha, Sara Shashaani.
Winter Simulation Conference 2023.

[C.3] **Improved Complexity of Trust-Region Optimization for Zeroth-Order Stochastic Oracles With Adaptive Sampling**.
Yunsoo Ha, Sara Shashaani, Quoc Tran-Dinh.
Winter Simulation Conference 2021.

Honors and Awards

- **Second Place Winner of the 2025 Pritsker Doctoral Dissertation Award** *2025*
  Institute of Industrial and Systems Engineers
- **Outstanding Reviewer Award** *2024*
  Winter Simulation Conference 2024
- **ISE Distinguished Dissertation Award of the 2024 CA Anderson Awards** *2024*
  North Carolina State University
- **Travel Awards for the 2023 Annual Midwest Optimization Meeting** *2023*
  Michigan State University
- **Mentored Teaching Fellowship** *2022*
  North Carolina State University
- **Scholarship for Excellent Academic Records** *2010, 2013-2016*
  Korea Aerospace University

Research Experience

- **National Renewable Energy Laboratory** *2024 – Present*
  Postdoctoral Researcher (Mentors: Juliane Mueller and Devon Sigler) USA
  - Designed an adaptive sampling rule for multi-fidelity simulation oracles.
  - Developed a novel stochastic trust region method for multi-fidelity stochastic optimization.
  - Developed a second-order optimizer that uses diagonal Hessian approximations for deep learning applications.
  - Developed a differentiable optimization algorithm for mixed-integer problems.
  - Developed a subspace-based optimizer for large-scale traffic signal control by learning subspaces via deep reinforcement learning.

- **North Carolina State University** *2019 – 2023*
  Research Assistant (Advisor: Sara Shashaani) USA
  - Analyzed the computational complexities with and without Common Random Numbers (CRN) in stochastic optimization, and theoretically demonstrated that CRN can significantly reduce the computational burden.
  - Enhanced the finite-time performance of the adaptive sampling trust-region method for simulation optimization through four key refinements:
    - Improved the chances of identifying better solutions through the integration of direct search techniques,
    - Constructed a quadratic model with diagonal Hessian within the trust region framework,
    - Reused previously evaluated solutions and corresponding simulation outputs to reduce computational cost,
    - Applied CRN to reduce the variance in function and gradient estimates.
  - Showed that the refined algorithms converge to the first-order stationary point almost surely.
  - Developed simulation optimization solvers and problems from scratch and tested them using Python (SimOpt).
  - Developed a stochastic oracle for traffic signal control problems, analyzed its loss landscape characteristics, and evaluated the performance of various solvers in addressing the problem (Poster).

- **Argonne National Laboratory** *Summer 2022*
  Summer Intern (Mentors: Matt Menickelly and Jeffrey Larson) USA
  ◦ Designed a gaussian process based trust region algorithm for noisy derivative-free optimization problems.

- **Argonne National Laboratory** *Summer 2021*
  Summer Intern (Mentors: Matt Menickelly and Matt Otten) USA
  ◦ Improved the randomized coordinate algorithm with adaptive sampling as a stochastic optimizer for variational hybrid quantum-classical algorithms.

- **Korea Aerospace University** *2015 - 2018*
  Researcher & Research Assistant (Advisor: Junjae Chae) South Korea
  ◦ Developed original heuristics for machine operations, including shuttle's dynamic allocation.
  ◦ Developed the decision model for the number of shuttles according to the demands.

Teaching Experience

- **ISE 362: Stochastic Models in Industrial Engineering** *Spring 2023*
  Instructor North Carolina State University
- **ISE 441: Introduction to Simulation** *Fall 2019, Spring 2020, Fall 2020, and Fall 2022*
  Teaching Assistant North Carolina State University
- **ISE 748: Quality Engineering** *Spring 2019*
  Teaching Assistant North Carolina State University
- **ISE 498: Senior Design Project** *Fall 2018*
  Teaching Assistant North Carolina State University
- **Analysis of Logistics System** *Fall 2015 and Fall 2016*
  Teaching Assistant Korea Aerospace University

Mentoring Experience

- **Graduate Students**
  ◦ Hyunwoo Shin (Ph.D. Candidate at Virginia Tech ISE) *Summer 2025 – Present*
- **Undergraduate Students**
  ◦ Kevin Xu (NCSU Statistics) *Fall 2022*
  ◦ Wes Hankinson (NCSU ISE) *Spring 2022*

Presentation

Invited Talks

- **International Symposium on Mathematical Programming** *2024*
  Two talks: Multi-Fidelity Stochastic Trust-Region Method, Is Building First-Order Simulation Oracles Really Worth It?
- **INFORMS Optimization Society Conference 2024** *2024*
  First-Order Trust-Region Methods with Adaptive Sampling.
- **2023 Annual Midwest Optimization Meeting** *2023*
  Common Random Numbers and Complexity in Simulation Optimization with Adaptive Sampling.
- **2023 INFORMS Annual Meeting** *2023*
  Consistency and Complexity of Adaptive Sampling Based Trust-Region Optimization.
- **Modeling and Optimization: Theory and Applications (MOPTA) 2023** *2023*
  Expediting Stochastic Derivative Free Optimization.
- **2022 INFORMS Annual Meeting** *2022*
  Complexity Analysis of Trust-Region Optimization with Adaptive Sampling for Zeroth-Order Stochastic Oracles.
- **INFORMS Optimization Society Conference 2022** *2022*
  Adaptive Sampling Trust-Region Optimization with Diagonal Hessian for Derivative-Free Stochastic Oracles.

Contributed Talks

- **Institute of Industrial and Systems Engineers Annual Conference 2025** *2025*
  First-Order Trust-Region Methods with Adaptive Sampling.

- **Winter Simulation Conference 2023** *2023*
  Towards Greener Stochastic Derivative-Free Optimization with Trust Regions and Adaptive Sampling.
- **Winter Simulation Conference 2021** *2021*
  Improved Complexity of Trust-Region Optimization for Zeroth-Order Stochastic Oracles with Adaptive Sampling.
- **Winter Simulation Conference 2020** *2020*
  Traffic Signal Control Simulation and Optimization (Poster).

Academic Service

- **Journal Refereeing**
  - Journal of Simulation
  - Journal of Scientific Computing
  - Computational Optimization and Applications
- **Conference Refereeing**
  - Winter Simulation Conference 2024-2025
- **Session Chair**
  - 2022, 2023, 2025 INFORMS Annual Meeting
  - Modeling and Optimization: Theory and Applications (MOPTA) 2023
  - Winter Simulation Conference 2023