Di Yu, Ph.D.

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Education

2021.08 – 2026.05 **Ph.D., Purdue University** Department of Statistics.
Advisor: ***Prof. Raghu Pasupathy***
Committee: ***Prof. Shane G. Henderson, Prof. Faming Liang, Prof. Jun Xie***
Key Coursework: *Computational Statistics, Statistical Machine Learning, Stochastic Optimization, Convex Optimization.*

2016.08 – 2017.12 **M.S., Georgia Institute of Technology** School of Industrial and Systems Engineering.
Key Coursework: *Financial Optimization, Stochastic Process.*

2011.09 – 2015.07 **B.S., Wuhan University** School of Mathematics and Statistics.
B.S., Wuhan University School of Economics and Management.
Key Coursework: *Dynamic Optimization, Functional Analysis, Econometrics.*

Awards and Honors

2025 **Best Contributed Theoretical Paper**, Winter Simulation Conference (WSC).
Bilsland Dissertation Fellowship, Purdue University.

Publication List

* Indicates co-first authorship.

Published Papers

1. **D. Yu**, S. G. Henderson, and R. Pasupathy, "Deterministic and stochastic Frank-Wolfe recursion on probability spaces," *Mathematics of Operations Research*, 2025. DOI: 10.1287/moor.2024.0584.
2. **D. Yu**, S. G. Henderson, and R. Pasupathy, "The derivative-free fully-corrective Frank–Wolfe algorithm for optimizing functionals over probability spaces," in *Proceedings of the 2025 Winter Simulation Conference (WSC)*, Best Contributed Theoretical Paper, 2025.
3. Z. Wang*, **D. Yu***, M. KhalilzadehFathi, and C. Pei, "Few-shot learning-enhanced tiered path planning for Mars rover navigation," in *2025 American Control Conference (ACC)*, IEEE, 2025, pp. 3500–3505. DOI: 10.23919/ACC63710.2025.11107497.
4. C. Pei, S. You, **D. Yu**, and R. Dai, "Multiphase iterative algorithm for mixed-integer optimal control," *Journal of Guidance, Control, and Dynamics*, vol. 48, no. 4, pp. 757–770, 2025. DOI: 10.2514/1.G008165.

Under Review

1. **D. Yu**, S. G. Henderson, and R. Pasupathy, "Frank-Wolfe recursions for the emergency response problem on measure spaces," *Stochastic Systems*, 2025, Under review. URL: https://arxiv.org/abs/2507.09808.
2. **D. Yu**, S. You, and C. Pei, "Convexifying mean-field control: An occupation-measure and Frank–Wolfe approach," in *2026 American Control Conference (ACC)*, Under review, 2025.
3. **D. Yu**, R. Pasupathy, and H. Chen, "On aggregating data when estimating the nonhomogeneous Poisson process rate function," Under review, 2021.

Working Papers

1. **D. Yu**, S. G. Henderson, and R. Pasupathy, "Interior-point Frank-Wolfe (ipfw) for linearly constrained functional optimization over probability spaces," Working paper, 2025.
2. **D. Yu**, R. Coetzer, and R. Pasupathy, "Frank–Wolfe methods for optimal design in nonlinear Padé mixture models," Working paper, 2025.

Industry Experience

2018 – 2021 **Quantitative Derivatives Trader,** Jinrui Capital Management, P.R. China

• Designed and executed high-frequency trading and market-making strategies, built market state classification models using statistical and machine learning methods, and managed a multi-instrument proprietary derivatives portfolio.

Research Experience

2025 – Present **Optimal Experimental Design with Fully-Corrective Frank-Wolfe (FCFW)**

• Investigating local and nonlocal experimental design problems for nonlinear models by framing design as functional optimization over probability measures. Current work applies FCFW to nonlinear designs such as the Padé mixture model, with real-world applications to industrial pressure-drop systems.

Frank-Wolfe Methods for Mean-Field Control via Occupation Measures

• Reformulated mean-field UAV swarm control as convex optimization over occupation measures. Designed a Frank-Wolfe recursion where the subproblem reduces to a tractable optimal control problem, enabling trajectory-update formulations and achieving $O(1/k)$ convergence.

2024 – Present **Derivative-Free Fully-Corrective Frank-Wolfe (FCFW) for Functional Optimization on Probability Spaces**

• Proposed a derivative-free FCFW recursion for optimizing smooth functionals on probability spaces in the zero-order setting, where only function evaluations are observable. Developed an estimator of the influence function via Monte Carlo and L_2 orthonormal projections, analyzed its bias and variance, and established rate behavior on smooth nonconvex problems, with applications to experimental design, emergency response, and moment problems.

Interior-Point Frank-Wolfe (IPFW) for Linearly Constrained Functional Optimization on Probability Spaces

• Proposed an interior-point Frank-Wolfe recursion that incorporates barrier objectives to handle linear functional constraints directly on probability spaces, with closed-form point-mass updates via influence functions and convergence guarantees, motivated by applications in experimental design, P-means, service systems, and moment problems.

2024 **Few-Shot Learning-Enhanced Tiered Path Planning for Mars Rover Navigation**

• Designed a tiered terrain-aware path planning strategy to navigate complex terrains, leveraging few-shot learning for terrain classification with minimal labeled data and a modified A* algorithm for real-time path optimization. Validated through simulations on Martian terrain data.

2022 – 2025 **Deterministic and Stochastic Frank-Wolfe Recursions on Probability Spaces**

• Introduced deterministic and stochastic Frank-Wolfe recursions that operate directly on infinite-dimensional probability spaces via the influence function, avoiding discretization and enabling particle-update formulations.

• Established convergence guarantees ($O(k^{-1})$ convex, $O(k^{-1/2})$ nonconvex), a fixed-step variant with exponential convergence, and a central limit theorem, with applications to emergency response, experimental design, Gaussian deconvolution, signal processing, and machine learning.

Frank-Wolfe for Emergency Response on Probability Spaces

• Formulated emergency response to out-of-hospital cardiac arrest (OHCA) as an infinite-dimensional optimization problem over measures, established convexity and existence results, derived the influence function, and adapted a fully-corrective Frank-Wolfe algorithm with convergence guarantees, validated on real OHCA data from Auckland, New Zealand.

2023-2024 **Multi-Phase Optimization Algorithm for Mixed-Integer Optimal Control**

• Developed a multi-stage, Second-Order Cone Programming (SOCP)-based iterative algorithm to address mixed-integer nonconvex optimization challenges, enhancing fuel efficiency in powered descent and advancing multi-point landing guidance with integrated hazard avoidance.

Research Experience (continued)

2020 – 2021 — **On Optimally Aggregating Data for Nonhomogeneous Poisson Process Estimation**
• Developed optimal data aggregation methods for NHPP rate estimation, deriving asymptotic MISE decay rates ($O(n^{-2/3})$, $O(n^{-3/4})$ finite horizon; $O(n^{-2/3})$, $O(n^{-4/5})$ infinite horizon) and designing practical estimators via roughness constant estimation that match theoretical efficiency.

Invited Talks

2025 — **Winter Simulation Conference**, *The Derivative-Free Fully-Corrective Frank-Wolfe Algorithm for Optimizing Functionals over Probability Spaces.*

INFORMS Annual Meeting, *The Derivative-Free Fully-Corrective Frank-Wolfe Algorithm for Optimizing Functionals over Probability Spaces.*

International Conference on Monte Carlo Methods and Applications (MCM), *Interior-Point Frank-Wolfe (IPFW) for Linearly Constrained Functional Optimization over Probability Spaces.*

2024 — **INFORMS Annual Meeting**, *Deterministic and Stochastic Frank-Wolfe Recursion on Probability Spaces.*

2023 — **INFORMS Annual Meeting**, *Deterministic and Stochastic Frank-Wolfe Recursions on Probability Spaces.*

SIAM Conference on Optimization, *Projected Measure Gradient Descent.*

Cornell Young Researchers Workshop (Poster), *Deterministic and Stochastic Frank-Wolfe Recursions on Probability Spaces.*

Teaching Experience

2025 Summer — **Teaching Assistant**, STAT 517: *Statistical Inference*. Co-designed midterm exam with instructor.

2025 Spring — **Teaching Assistant**, STAT 553: *Theory of Linear Models and Analysis of Experimental Designs.*

2023–2025 — **Teaching Assistant**, MA/STAT 538–539: *Probability Theory I & II*. Graduate-level, proof-based courses in probability. Supported multiple semesters.

2024 Fall — **Teaching Assistant**, STAT 519: *Introduction to Probability Theory.*

2024–2025 — **Teaching Assistant**, STAT 511: *Statistical Methods*. Led lab sessions for undergraduates across multiple semesters.

2023 Fall — **Teaching Assistant**, STAT 695: *Theory of Multivariate Statistics and Random Matrices*. Ph.D.-level topics course with over 20 students.

Teaching Assistant, STAT 545: *Introduction to Computational Statistics*. Designed coding-based assignments on computational statistics.

2023 Spring — **Teaching Assistant**, STAT 301: *Elementary Statistical Methods*. Created and led lab sections for 200+ undergraduates from diverse backgrounds.

2022 Fall — **Teaching Assistant**, MA/STAT 532: *Stochastic Processes.*

2024 Fall — **Guest Lecturer**, Study Group on *Duality in Infinite-dimensional Optimization*. Delivered two lectures on Functional Analysis and Duality.

2023 Spring — **Guest Lecturer**, Study Group on *Empirical Processes*. Delivered two lectures on consistency of empirical processes with practical examples.

Professional Societies

2022–Present — Member, INFORMS Computing Society, Simulation Society, and Applied Probability Society

2023–Present — Member, SIAM (Society for Industrial and Applied Mathematics).

Service

2025 **Session Chair**, *Algorithmic Advances in Simulation Optimization II*, Winter Simulation Conference (WSC).

2024–2025 **Reviewer**, Winter Simulation Conference (WSC).

2025 **Outstanding Reviewer**, Winter Simulation Conference (WSC).

Expertise

- **Optimization**: Optimization over Probability Spaces, Stochastic and Nonconvex Optimization.
- **Statistics**: Advanced Simulation Techniques, Sampling Methods, and Statistical Inference.
- **Machine Learning**: Learning Theory, Statistical Learning, and Deep Neural Networks.