Sungho Shin

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Education and Training

Argonne National Laboratory, Lemont, IL	2021–2024
Postdoc in Mathematics and Computer Science Division	
University of Wisconsin-Madison, Madison, WI	2021
Ph.D. in Chemical Engineering	
Seoul National University, Seoul, South Korea	2016
B.S. in Chemical Engineering and B.S. in Mathematics	

Professional Appointments

Assistant Professor	2024-Present
Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA	
Postdoctoral Appointee (Supervisor: Mihai Anitescu)	2021-2024
Mathematics and Computer Science Division, Argonne National Laboratory, Lemont, IL	
Research Assistant (Supervisor: Victor M. Zavala)	2016–2021
Department of Chemical and Biological Engineering , University of Wisconsin-Madison, Madison, WI	
Research Intern (Supervisors: Carleton Coffrin and Kaarthik Sundar)	2020
Advanced Network Science Initiative , Los Alamos National Laboratory, Los Alamos, NM	
Research Intern (Supervisor: Mihai Anitescu)	2018
Mathematics and Computer Science Division, Argonne National Laboratory, Lemont, IL	

Honors and Awards

COIN-OR Cup, Computational Infrastructure for Operations Research	2023
W. David Smith, Jr. Graduate Publication Award, AIChE	2023
Young Author Award, IFAC Conference on Nonlinear Model Predictive Control	2021
Young Author Award, IFAC International Symposium on Advanced Control of Chemical Processes	2021
CAST Directors' Student Presentation Award, AIChE	2020
Grainger Wisconsin Distinguished Graduate Fellowship, University of Wisconsin-Madison	2020–2021
Kwanjeong Scholarship, Kwanjeong Educational Foundation	2016–2020
Korea Presidential Science Scholarship, Korea Student Aid Foundation	2010–2016

Selected Publications

[P10] S. Shin, F. Pacaud, and M. Anitescu. Accelerating optimal power flow with GPUs: SIMD abstraction of nonlinear programs and condensed-space interior-point methods. In *XXIII Power Systems Computation Conference*, 2024, arXiv:2307.16830. Accepted.

[P9] F. Pacaud, M. Schanen, S. Shin, D. A. Maldonado, and M. Anitescu. Parallel interior-point solver for block-structured nonlinear programs on SIMD/GPU architectures. *Optimization Methods and Software*, arXiv:2301.04869. Accepted.

[P8] F. Pacaud, S. Shin, M. Schanen, D. A. Maldonado, and M. Anitescu. Accelerating condensed interior-point methods on SIMD/GPU architectures. *Journal of Optimization Theory and Applications*, pages 1–20, 2023, arXiv:2203.11875. doi:10.1007/s10957-022-02129-5.

[P7] S. Shin, Y. Lin, G. Qu, A. Wierman, and M. Anitescu. Near-optimal distributed linear-quadratic regulator for networked systems. *SIAM Journal on Control and Optimization*, 61(3):1113–1135, 2023, arXiv:2204.05551. doi:10.1137/22M1489836.

[P6] S. Shin and V. M. Zavala. Diffusing-horizon model predictive control. *IEEE Transactions on Automatic Control*, 2023, arXiv:2002.08556. doi:10.1109/TAC.2021.3137100.

[P5] S. Na*, S. Shin*, M. Anitescu, and V. M. Zavala. On the convergence of overlapping schwarz decomposition for nonlinear optimal control. *IEEE Transactions on Automatic Control*, 2022, arXiv:2005.06674. doi:10.1109/TAC.2022.3194087. *Equal contribution.

[P4] J. Jalving, S. Shin, and V. M. Zavala. A graph-based modeling abstraction for optimization: Concepts and implementation in Plasmo.jl. *Mathematical Programming Computation*, 2022, arXiv:2006.05378. doi:10.1007/s12532-022-00223-3.

[P3] S. Shin, M. Anitescu, and V. M. Zavala. Exponential decay of sensitivity in graph-structured nonlinear programs. *SIAM Journal on Optimization*, 32(2):1156–1183, 2022, arXiv:2101.03067. doi:10.1137/21M1391079.

[P2] S. Shin, V. M. Zavala, and M. Anitescu. Decentralized schemes with overlap for solving graph-structured optimization problems. *IEEE Transactions on Control of Network Systems*, 7(3):1225–1236, 2020, arXiv:1810.00491. doi:10.1109/TCNS.2020.2967805.

[P1] S. Shin, P. Hart, T. Jahns, and V. M. Zavala. A hierarchical optimization architecture for large-scale power networks. *IEEE Transactions on Control of Network Systems*, 6(3):1004–1014, 2019, arXiv:2002.09796. doi:10.1109/TCNS.2019.2906917.

Grants

- PI. Multi-Scale Production Cost Modeling for Optimal Storage Investment. MIT Energy Initiative. Total $304,524. 2024-2025.
- PI. Analyzing the Ripple Effect of Consumer Flexibility on Utility Scale Energy System Investments. EQUINOR. Total $100,000. 2024-2025.

Software Products

[S1] **MadNLP.jl** (Main developer): a nonlinear programming solver for GPUs

[S2] **ExaModels.jl** (Main developer): an algebraic modeling system for GPUs.

[S3] **Plasmo.jl** (Main developer): a graph-based modeling platform.

Synergetic Activities

- Contributed to conference organization, including organizer of "accelerated computing for mathematical programming" session at INFORMS Annual Meeting (2024), International Program Committee of IFAC NMPC Conference (2024), and session reviewer and chair of AIChE CAST Division (2022, 2024).
- Served as journal reviewer, including IEEE Transactions on Automatic Control, Automatica, and SIAM Journal on Optimization, and many others.
- Given several invited seminars, including Los Alamos National Laboratory (2024), Oklahoma State University (2024), Purdue University (2024), AIChE CAST Webinar series (2024), Grid Science Winter School and Conference (2023), Seoul National University (2023, 2022), Trier University (2021), Caltech (2021), University of Bayrueth (2020)
- Contributed department activities at MIT to promote diversity in the field, including Rising Stars in Chemical Engineering (2024).