Sungho Shin

Incoming Assistant Professor, Department of Chemical Engineering, Massachusetts Institute of Technology
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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 — Starting on 7/1/2024
Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA

Postdoctoral Appointee (Supervisor: Mihai Anitescu) — 2021–Present
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

Grants

N/A

Selected Publications

[P13] **S. Shin**, S. Na, and M. Anitescu. Near-optimal performance of stochastic predictive control, arXiv:2210.08599. Under Review.

[P12] **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.

[P11] 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.

[P10] 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.

[P9] **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.

[P8] **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.

[P7] 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.

[P6] 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.

[P5] **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.

[P4] **S. Shin** and V. M. Zavala. Controllability and observability imply exponential decay of sensitivity in dynamic optimization. In *7th IFAC Conference on Nonlinear Model Predictive Control*, volume 54, pages 179–184, 2021, arXiv:2101.06350. doi:10.1016/j.ifacol.2021.08.542. Young Author Award.

[P3] **S. Shin**, C. Coffrin, K. Sundar, and V. M. Zavala. Graph-based modeling and decomposition of energy infrastructures. In *11th IFAC International Symposium on Advanced Control of Chemical Processes*, volume 54, pages 693–698, 2021, arXiv:2010.02404. doi:10.1016/j.ifacol.2021.08.322. Keynote Paper, Young Author Award.

[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.

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.

Invited Talks

2024 – Los Alamos National Laboratory (planned), University of Oklahoma (planned), Purdue University (planned), Brigham Young University (planned)
2023 – Grid Science Winter School, Seoul National University (virtual)
2022 – Seoul National University (virtual)
2021 – Caltech (virtual), Trier University (virtual), UW-Madison (virtual)
2020 – University of Bayreuth (virtual)

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