

Sungho Shin

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Education

University of Wisconsin-Madison, Ph.D. in Chemical Engineering (Advisor: Victor M. Zavala)	2021
Seoul National University, B.S. in Mathematics and Chemical Engineering	2016

Research Interests

control theory; model predictive control; nonlinear optimization; stochastic optimization; energy systems

Professional Appointments

Postdoctoral Appointee (Supervisor: Mihai Anitescu) Mathematics and Computer Science Division, Argonne National Laboratory.	2021–Present
Research Assistant (Supervisor: Victor M. Zavala) Department of Chemical and Biological Engineering, University of Wisconsin-Madison.	2016–2021
Research Intern (Supervisor: Carleton Coffrin and Kaarthik Sundar) Advanced Network Science Initiative, Los Alamos National Laboratory.	2020
Research Intern (Supervisor: Mihai Anitescu) Mathematics and Computer Science Division, Argonne National Laboratory.	2018
Research Intern (Supervisor: Jong Min Lee) Energy Process Engineering Laboratory, Seoul National University.	2016

Honors and Awards

IFAC NMPC Young Author Award	2021
IFAC ADCHEM Young Author Award	2021
AICHE CAST Directors' Student Presentation Award	2020
Grainger Wisconsin Distinguished Graduate Fellowship	2020–2021
Kwanjeong Scholarship	2016–2020
Korea Presidential Science Scholarship	2010–2016

Publications

Under Review

[U1] A. Engelmann, **S. Shin**, F. Pacaud, and V. M. Zavala. Scalable primal decomposition schemes for large-scale infrastructure networks, 2022, [arxiv:2212.11571](https://arxiv.org/abs/2212.11571). Under Review.

Journal Publications

[J12] **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*, 2023, [arXiv:2204.05551](https://arxiv.org/abs/2204.05551). Accepted.

[J11] F. Pacaud, **S. Shin**, M. Schanen, D. A. Maldonado, and M. Anitescu. Condensed interior-point methods: porting reduced-space approaches on GPU hardware. *Journal of Optimization Theory and Applications*, 2023, [arXiv:2203.11875](https://arxiv.org/abs/2203.11875). Accepted.

- [J10] **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](#).
- [J9] F. Pacaud, D. A. Maldonado, **S. Shin**, M. Schanen, and M. Anitescu. A feasible reduced space method for real-time optimal power flow. *Electric Power Systems Research*, 212:108268, 2022, [arXiv:2110.02590](#). doi:[https://doi.org/10.1016/j.epsr.2022.108268](#).
- [J8] D. L. Cole, **S. Shin**, and V. Zavala. A julia framework for graph-structured nonlinear optimization. *Industrial & Engineering Chemistry Research*, 2022, [arXiv:2204.05264](#). doi:[https://doi.org/10.1021/acs.iecr.2c01253](#).
- [J7] 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.
- [J6] J. Jalving, **S. Shin**, and V. M. Zavala. A graph-based modeling abstraction for optimization: Concepts and implementation in Plasmojl. *Mathematical Programming Computation*, 2022, [arXiv:2006.05378](#). doi:[10.1007/s12532-022-00223-3](#).
- [J5] **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](#).
- [J4] **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](#).
- [J3] **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](#).
- [J2] **S. Shin**, O. S. Venturelli, and V. M. Zavala. Scalable nonlinear programming framework for parameter estimation in dynamic biological system models. *PLoS Computational Biology*, 15(3):e1006828, 2019. doi:[10.1371/journal.pcbi.1006828](#).
- [J1] D. S. Kim, **S. Shin**, G. B. Choi, K. H. Jang, J. C. Suh, and J. M. Lee. Diagnosis of partial blockage in water pipeline using support vector machine with fault-characteristic peaks in frequency domain. *Canadian Journal of Civil Engineering*, 44(9):707–714, 2017. doi:[10.1139/cjce-2016-0615](#).

Conference Publications

- [C8] **S. Shin**, F. Pacaud, E. Contantinescu, and M. Anitescu. Constrained policy optimization for stochastic optimal control under nonstationary uncertainties. In *2023 American Control Conference (ACC)*, 2023, [arXiv:2209.13050](#). Accepted.
- [C7] D. Cole, **S. Shin**, F. Pacaud, V. M. Zavala, and M. Anitescu. Exploiting GPU/SIMD architectures for solving linear-quadratic MPC problems. In *2023 American Control Conference (ACC)*, 2023, [arXiv:2209.13049](#). Accepted.
- [C6] **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.
- [C5] **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.
- [C4] **S. Shin**, M. Anitescu, and V. M. Zavala. Overlapping Schwarz decomposition for constrained quadratic programs. In *2020 59th IEEE Conference on Decision and Control (CDC)*, pages 3004–3009, 2020, [arXiv:2003.07502](#). doi:[10.1109/CDC42340.2020.9304139](#).
- [C3] Q. Lu, **S. Shin**, and V. M. Zavala. Characterizing the predictive accuracy of dynamic mode decomposition for data-driven control. In *21th IFAC World Congress*, volume 53, pages 11289–11294, 2020, [arXiv:2003.01028](#). doi:[https://doi.org/10.1016/j.ifacol.2020.12.373](#).
- [C2] **S. Shin**, T. Faulwasser, M. Zanon, and V. M. Zavala. A parallel decomposition scheme for solving long-horizon optimal control problems. In *2019 IEEE 58th Conference on Decision and Control (CDC)*, pages 5264–5271, 2019, [arXiv:1903.01055](#). doi:[10.1109/CDC40024.2019.9030139](#).

- [C1] **S. Shin**, A. D. Smith, S. J. Qin, and V. M. Zavala. On the convergence of the dynamic inner PCA algorithm. In *Foundations of Process Analytics and Machine Learning*, 2019, [arXiv:2003.05928](#).