

# Sungho Shin

Postdoctoral Appointee (email: [sshin@anl.gov](mailto:sshin@anl.gov))  
Mathematics and Computer Science Division,  
Argonne National Laboratory

## Education

**Ph.D. in Chemical Engineering, University of Wisconsin-Madison** (2021; Advisor: Victor M. Zavala)

**B.S. in Mathematics and Chemical Engineering, Seoul National University** (2016).

## Professional Appointments

**Postdoctoral Appointee** (June 2021 – Present), Mathematics and Computer Science Division, Argonne National Laboratory. (Supervisor: Mihai Anitescu).

**Research Assistant** (Sept. 2016 – May 2021), Department of Chemical and Biological Engineering, University of Wisconsin-Madison. (Supervisor: Victor M. Zavala).

**Research Intern** (June 2020 – Sept. 2020), Advanced Network Science Initiative, Los Alamos National Laboratory. (Supervisor: Carleton Coffrin and Kaarthik Sundar).

**Research Intern** (May 2018 – Aug. 2018), Mathematics and Computer Science Division, Argonne National Laboratory. (Supervisor: Mihai Anitescu).

**Research Intern** (Jan. 2016 – June 2016), Energy Process Engineering Laboratory, Seoul National University. (Supervisor: Jong Min Lee).

## Honors and Awards

**IFAC NMPC Young Author Award** (July 2021).

**IFAC ADCHEM Young Author Award** (June 2021).

**AIChE CAST Directors' Student Presentation Award** (Nov. 2020).

**Grainger Wisconsin Distinguished Graduate Fellowship** (Sept. 2020 – June 2021).

**Kwanjeong Scholarship** (Sept. 2016 – Aug. 2020).

**Korea Presidential Science Scholarship** (Mar. 2010 – Feb. 2016).

## Publications

### Thesis

[T1] **S. Shin**. *Graph-Structured Nonlinear Programming: Properties and Algorithms*. The University of Wisconsin-Madison, 2021.

### Journal Publications

[J10] D. L. Cole, **S. Shin**, and V. Zavala. A julia framework for graph-structured nonlinear optimization. [arXiv:2204.05264](https://arxiv.org/abs/2204.05264). Under Review.

[J9] F. Pacaud, **S. Shin**, M. Schanen, D. A. Maldonado, and M. Anitescu. Condensed interior-point methods: porting reduced-space approaches on GPU hardware. [arXiv:2203.11875](https://arxiv.org/abs/2203.11875). Under Review.

[J8] J. Jalving, **S. Shin**, and V. M. Zavala. A graph-based modeling abstraction for optimization: Concepts and implementation in Plasmojl. [arXiv:2006.05378](https://arxiv.org/abs/2006.05378). Under Review.

[J7] S. Na\*, **S. Shin**\*, M. Anitescu, and V. M. Zavala. Overlapping Schwarz decomposition for nonlinear optimal control. [arXiv:2005.06674](https://arxiv.org/abs/2005.06674). Under Review. \*Equal contribution.

- [J6] **S. Shin**, M. Anitescu, and V. M. Zavala. Exponential decay of sensitivity in graph-structured nonlinear programs. *SIAM Journal on Optimization*, 2022, [arXiv:2101.03067](#). Accepted.
- [J5] **S. Shin** and V. M. Zavala. Diffusing-horizon model predictive control. *IEEE Transactions on Automatic Control*, 2022, [arXiv:2002.08556](#). doi:[10.1109/TAC.2021.3137100](#).
- [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

- [C7] F. Pacaud, D. A. Maldonado, **S. Shin**, M. Schanen, and M. Anitescu. A feasible reduced space method for real-time optimal power flow. In *27th Power Systems Computation Conference*, 2022, [arXiv:2110.02590](#). 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](#).

## Invited Talks

- [I5] **S. Shin**. Scalable decision-making for energy infrastructures: Theory, algorithms, and software. Young Researcher Symposium, Seoul National University (Virtual), 2022.
- [I4] **S. Shin**, M. Anitescu, and V. M. Zavala. Graph-structured nonlinear programming: Properties and algorithms. ALOP colloquium, Trier University (Virtual), 2021.
- [I3] **S. Shin**, M. Anitescu, and V. M. Zavala. Graph-structured nonlinear programming: Properties and algorithms. Rigorous Systems Research Group, Caltech (Virtual), 2021.
- [I2] **S. Shin** and V. M. Zavala. Graph-structured optimization for energy infrastructures. Department of Chemical and Biological Engineering Seminar, University of Wisconsin-Madison (Virtual), 2021.
- [I1] **S. Shin**, M. Anitescu, and V. M. Zavala. Exponential decay of sensitivity in graph-structured nonlinear programs. University of Bayreuth (Virtual), 2020.