Sungho Shin

Postdoctoral Appointee (email: 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

[J11] **S. Shin**, Y. Lin, G. Qu, A. Wierman, and M. Anitescu. Near-optimal distributed linear-quadratic regulator for networked systems. arXiv:2204.05551. Under Review.

[J10] D. L. Cole, **S. Shin**, and V. Zavala. A julia framework for graph-structured nonlinear optimization. arXiv: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. Under Review.

[J8] 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. Accepted.

[J7] S. Na*, **S. Shin***, M. Anitescu, and V. M. Zavala. Overlapping Schwarz decomposition for nonlinear optimal control. arXiv: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.