Sungho Shin

Ph.D. Candidate
Department of Chemical and Biological Engineering,
University of Wisconsin-Madison
sungho.shin@wisc.edu

Education

Ph.D. in Chemical Engineering (Sept. 2016 – 2021, Expected)
University of Wisconsin-Madison, Madison, Wisconsin, USA. (Advisor: Victor M. Zavala)

B.S. in Mathematics and **Chemical Engineering** (Mar. 2010 – Feb. 2016*)
Seoul National University, Seoul, South Korea.
*Military service in Republic of Korea Army (Apr. 2012 – Jan. 2014).

Professional Experience

Research Assistant (Sept. 2016 – Present), 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), Division of Mathematics and Computer Science, Argonne National Laboratory. (Supervisor: Mihai Anitescu).

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

Honors and Awards

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

Grainger Wisconsin Distinguished Graduate Fellowship (Sept. 2020 – Aug. 2021, Expected).

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

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

Publications

Journal Publications

[J10] **S. Shin**, M. Anitescu, and V. M. Zavala. Overlapping schwarz decomposition for graph-structured nonlinear programs. 2021. In Preparation.

[J9] **S. Shin**, M. Anitescu, and V. M. Zavala. Exponential decay of sensitivity in graph-structured nonlinear programs. 2021, arXiv:2101.03067. Under Review.

[J8] J. Jalving, **S. Shin**, and V. M. Zavala. A graph-based modeling abstraction for optimization: Concepts and implementation in Plasmo.jl. 2020, arXiv:2006.05378. Under Review.

[J7] S. Na, **S. Shin**, M. Anitescu, and V. M. Zavala. Overlapping schwarz decomposition for nonlinear optimal control. 2020, arXiv:2005.06674. Under Review.

[J6] **S. Shin**, Q. Lu, and V. M. Zavala. Unifying theorems for subspace identification and dynamic mode decomposition. 2020, arXiv:2003.07410. Under Review.

[J5] **S. Shin** and V. M. Zavala. Diffusing-horizon model predictive control. 2020, arXiv:2002.08556. Under Review.

[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*, 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

[C6] **S. Shin** and V. M. Zavala. Exponential decay of sensitivity in nonlinear model predictive control: A graph-theoretic approach. 2021, arXiv:2101.06350. Under Review.

[C5] **S. Shin**, C. Coffrin, K. Sundar, and V. M. Zavala. Graph-based modeling and decomposition of energy infrastructures. 2020, arXiv:2010.02404. Accepted as a Keynote Paper.

[C4] **S. Shin**, M. Anitescu, and V. M. Zavala. Overlapping schwarz decomposition for constrained quadratic programs. In *2020 IEEE 59th Conference on Decision and Control (CDC)*, 2020, arXiv:2003.07502.

[C3] Q. Lu, **S. Shin**, and V. M. Zavala. Characterizing the predictive accuracy of dynamic mode decomposition for data-driven control. In *IFAC World Congress*, 2020, arXiv:2003.01028.

[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.

Book Chapters and Technical Reports

[B3] P. F. Lang, **S. Shin**, and V. M. Zavala. Sbml2julia: interfacing sbml with efficient nonlinear julia modelling and solution tools for parameter optimization. 2020, arXiv:2011.02597.

[B2] **S. Shin** and V. M. Zavala. Computing economic-optimal and stable equilibria for droop-controlled microgrids. 2018, arXiv:2002.09802.

[B1] **S. Shin** and V. M. Zavala. Multi-grid schemes for multi-scale coordination of energy systems. In *Energy Markets and Responsive Grids*, pages 195–222. Springer, 2018, arXiv:2002.10680. doi:10.1007/978-1-4939-7822-9_9.

Presentations

Invited Talks

[I1] **S. Shin**, M. Anitescu, and V. M. Zavala. Exponential decay of sensitivity in graph-structured nonlinear programs. University of Bayrueth (Virtual), 2020.

Conference Talks

[P11] **S. Shin**, M. Anitescu, and V. M. Zavala. Overlapping schwarz decomposition for constrained quadratic programs. 58th IEEE Conference on Decision and control (Virtual), 2020.

[P10] **S. Shin**, V. M. Zavala, and M. Anitescu. Unifying theorems for unifying theorems for subspace identification and dynamic mode decomposition. AIChE Annual Meeting (Virtual), 2020.

[P9] **S. Shin** and V. M. Zavala. Diffusing-horizon model predictive control. AIChE Annual Meeting (Virtual), 2020.

[P8] **S. Shin**, M. Anitescu, and V. M. Zavala. Overlapping domain decomposition schemes for solving graph-structured optimization problems. AIChE Annual Meeting (Virtual), 2020.

[P7] **S. Shin**, O. S. Venturelli, and V. M. Zavala. Large-scale estimation techniques for dynamic microbial community networks. TWCCC Fall Meeting, Madison, WI, 2017.

[P6] **S. Shin**, A. D. Smith, S. J. Qin, and V. M. Zavala. Optimization algorithms for dynamic latent variable problems. MLSE, Atlanta, GA, 2019.

[P5] **S. Shin**, T. Faulwasser, M. Zanon, and V. M. Zavala. A parallel decomposition scheme for solving long-horizon optimal control problems. 58th IEEE Conference on Decision and control, Nice, France, 2019.

[P4] **S. Shin**, V. M. Zavala, and M. Anitescu. Overlapping domain decomposition schemes for solving graph-structured optimization problems. AIChE Annual Meeting, Orlando, FL, 2019.

[P3] **S. Shin** and V. M. Zavala. Low-rank system identificaiton from high-dimensional data. Computing in Engineering Forum, Madison, WI, 2019.

[P2] **S. Shin** and V. M. Zavala. Stability-preserving economic optimization of microgrids. AIChE Annual Meeting, Pittsburgh, PA, 2018.

[P1] **S. Shin** and V. M. Zavala. Multi-grid (hierarchical) control of power networks. AIChE Annual Meeting, Minneapolis, MN, 2017.

Software Products

MadNLP.jl (Main developer): a solver for nonlinear programming.

Plasmo.jl (Contributor): a graph-based algebraic modeling framework.

SBML2Julia (Contributor): a tool to for optimizing parameters of an ordinary differential equation (ODE) model in SBML format.

Teaching Experience

Teaching Assistant, Statistics for Chemical Engineers, UW-Madison (Spring 2019)

Teaching Assistant, Process Dynamics and Control, UW-Madison (Fall 2018, Fall 2017)

Tutor, Process Control and Design, Seoul National University (Fall 2015)

Tutor, Process Fluid Mechanics, Seoul National University (Spring 2015)

Tutor, Basic Chemistry, Seoul National University (Spring 2015)

Mentoring Experience

Undergraduate: Sang-il Kwon (UW-Madison, Fall 2017)

Peer Review Services

AIChE Journal, Computers & Chemical Engineering, IEEE Control Systems Letters, IEEE Transactions on Control Systems Technology, IEEE Transactions on Automatic Control, IFAC International Symposium on Advanced Control of Chemical Processes, Industrial & Engineering Chemistry Research, Journal of Optimization Theory and Applications

Other Skills

Language: English and Korean

Programming: Julia, MATLAB, Python, C/C++

Last updated: February 15, 2021