

# Sungho Shin

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## 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 Laboratory, 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

- [J9] **S. Shin**, M. Anitescu, and V. M. Zavala. Overlapping schwarz decomposition for graph-structured nonlinear programs. 2021. In Preparation.
- [J8] **S. Shin**, M. Anitescu, and V. M. Zavala. Exponential decay of sensitivity in graph-structured nonlinear programs. 2021, [arXiv:2101.03067](https://arxiv.org/abs/2101.03067). Under Review.
- [J7] 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](https://arxiv.org/abs/2006.05378). Under Review.
- [J6] S. Na, **S. Shin**, M. Anitescu, and V. M. Zavala. Overlapping schwarz decomposition for nonlinear optimal control. 2020, [arXiv:2005.06674](https://arxiv.org/abs/2005.06674). 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

- [B4] 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](#).
- [B3] **S. Shin**, Q. Lu, and V. M. Zavala. Unifying theorems for subspace identification and dynamic mode decomposition. 2020, [arXiv:2003.07410](#).
- [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 Bayreuth (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 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 identification 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*