

# SICONG GUO

1781 Cram Cir.,  
Apt. 2,  
Ann Arbor, MI 48105-2217

Phone: (734) 358-3686  
Email: [stevengu@umich.edu](mailto:stevengu@umich.edu)  
Homepage: <https://steven2016gsc.github.io>

## PARTICULARS

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### EDUCATION

University of Michigan MSE in Computer Science & Engineering	Ann Arbor, MI <i>August 2024 - May 2026</i>
University of Michigan MSE in Mechanical Engineering	Ann Arbor, MI <i>August 2020 - December 2021</i>
University of Michigan BSE in Mechanical Engineering; minor in Electrical Engineering	Ann Arbor, MI <i>August 2017 - May 2020</i>
University of Pittsburgh Major in Mechanical Engineering and Material Science	Pittsburgh, PA <i>August 2015 - May 2017</i>

### RESEARCH INTERESTS

My research interests span the areas of control synthesis and verification, cyber-physical systems, optimization, and machine learning. I have a specific interest in specification-driven learning, compositional verification and runtime assurance.

## ACADEMIC HONORS

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- University Honors: Dean's List, University of Michigan, 2017-2021.
- University Honors: Magna Cum Laude, University of Michigan, 2020.
- University Honors: Dean's List, University of Pittsburgh, 2015-2017.

## RESEARCH EXPERIENCE

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- **Research Assistant, University of Michigan**, May 2018 - Present.  
**Traffic Rule Compliant Autonomous Driving**, (June 2025 - Present):
  - Study various driving scenarios including highway car-following and urban driving at unsignalized intersections with stop-sign enforcements, where compliance objectives are inherently non-Markovian.
  - Encode traffic rules like “stop-before-go” into *reward machines* and integrate them into RL framework to evaluate and compare performance with baselines.
- **A collaborative process parameter recommender system for fleets of networked manufacturing machines**, (September 2024 - December 2025):
  - Addressed fleet-scale process-parameter optimization via *sequential matrix completion*.
  - Applied spectral clustering (for rank estimate) and alternating least squares (for matrix completion) to realize collaborative process parameter optimization across machines.
- **Uncertainty Propagation for Non-Gaussian Systems**, (July 2023 – January 2024):
  - Developed a sparse spectral Galerkin method to propagate uncertainty in nonlinear, non-Gaussian dynamical systems.
  - Improved online computation efficiency for higher-dimensional settings via sparse representations and implementation-level optimization.

**Traffic Control by Connected Automated Vehicles**, (May 2021 - June 2023):

- Regulated traffic in mixed autonomy platoons by coordinating paired CAVs.
- Demonstrated that coordinated CAV pairs can stabilize traffic and suppress stop-and-go waves even at low CAV penetration.

**Convex Optimization for Spring Design of Parallel Elastic Actuators**, (May 2021 - May 2022):

- Added auxiliary elasticity in parallel with the motor to compensate static torque at robotic joints; formulated motor energy consumption as a convex function of elasticity.
- Optimized the elasticity design with reduced motor energy consumption under actuator constraints.

**CPS: Synergy: Connected Testbeds for Connected Vehicles**, (May 2018 - August 2020):

- Developed a model-free predictive framework to compensate network delays with extended design degree of freedom; established stability criterion in terms of design parameters and the constant network delay.
- Experimentally validated robust delay-compensation performance with up to 30% higher integration fidelity than previous work.

## INTERNSHIPS

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• **Software and Controls Engineer, Ulendo Technologies, Inc.**, May 2022 - September 2024.

- Calibrated stepper motors on 3D printers in terms of frequency response function data.
- Incorporated offline filtered B-splines (FBS) method into the OEM firmware on the 3D printer; compensated vibrations on the nozzle under high-speed printing.
- Experimentally validated the vibration compensation performance on commercial 3D printers.

## PUBLICATIONS

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### PAPERS

1. Sicong Guo, Gábor Orosz, and Tamas G. Molnar. “Connected cruise and traffic control for pairs of connected automated vehicles”. *IEEE Transactions on Intelligent Transportation Systems*, 24(11):12648–12658, 2023.
2. Sicong Guo, Robert D. Gregg, and Edgar Bolívar-Nieto. “Convex optimization for spring design of parallel elastic actuators”. In *2022 American Control Conference (ACC)*, pages 3688–3694, 2022.
3. Sicong Guo, Yuzhang Liu, Yingshi Zheng, and Tulga Ersal. “A delay compensation framework for connected testbeds”. *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, 52(7):4163–4176, 2022.
4. Sicong Guo, and Xiaoshuang Pan. “A New Perspective on the Derivation of Common Divisors and Common Multiples using Set Theory”. *Journal of Research on Math*, 2015(1)36-38, China Northeast Normal Univ. Press.

### PAPERS UNDER REVIEW

5. Weishi Wang, Sicong Guo, Chenhuan Jiang, Mohamed Elidrisi, Myungjin Lee, Harsha V. Madhyastha, Raed Al Kontar, and Chinedum E. Okwudire. “A collaborative process parameter recommender system for fleets of networked manufacturing machines – with application to 3d printing”. *Journal of Manufacturing Systems*. Currently available at <https://arxiv.org/abs/2506.12252>.

## PATENTS

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1. S. Guo, “A new design of windscreen wiper on automobile”, utility patent #201721366698.4, 2016, The State Intellectual Property Office of China.
2. S. Guo, “Improvements on cooling mechanism in computer case”, utility patent #2016207997063.0, 2015, The State Intellectual Property Office of China.

## SKILLS & LANGUAGES

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Programming Languages: C/C++, Python, MATLAB & Simulink, Mathematica, ROS, Java, JavaScript.

Engineering Software: solidThinking Inspire, MSC ADAMS, NX, Teamcenter, Pro/E, SolidWorks.

Documentation: LaTeX, Microsoft Office.

Human Languages: English (proficient); Mandarin Chinese (native).