SooJean Han

soojean(at)caltech.edu | linkedin.com/in/soojean-han | soojean.github.io

Education

California Institute of Technology (Caltech) — Pasadena, CA, USA
Ph.D. Controls and Dynamical Systems — *Sep. 2017*

University of California, Berkeley (UC Berkeley) — Berkeley, CA, USA
B.S. Electrical Engineering and Computer Science and B.S. Applied Mathematics — *Jun. 2014 - Dec. 2016*

Awards & Fellowships

NSF GRFP — Jun. 2019 - Jun. 2022

Caltech Special EAS Fellowship — Jun. 2017 - Jun. 2019

Publications

Publications

- SooJean Han and Soon-Jo Chung. Incremental Nonlinear Stability Analysis for Stochastic Systems Perturbed by Lévy Noise. *International Journal of Robust and Nonlinear Control*, 32(12):7174–7201, Aug 2022. [Link]
- SooJean Han, Michelle Effros, and Richard M. Murray. (outformation: Distributed data gathering with feedback under uncertain environment and communication delay constraints). In *IEEE 61st Annual Conference on Decision and Control*, To appear 2022. [Link]
- SooJean Han. Localized Learning of Robust Controllers for Networked Systems with Dynamic Topology. In *Proceedings of the 2nd Conference on Learning for Dynamics and Control (L4DC)*, volume 120 of *Proceedings of Machine Learning Research*, pages 687–696. PMLR, 2020. [Link]
- SooJean Han, Soon-Jo Chung, and John C. Doyle. Predictive Control of Linear Discrete-Time Markovian Jump Systems via the Analysis of Recurrent Patterns. *Under review at Automatica*, Jul 2022. [Link]
- Shih-Hao Tseng, SooJean Han, and Adam Wierman. Trading throughput for freshness: Freshness-aware traffic engineering and in-network freshness control. Under review at ACM Transactions on Modeling and Performance Evaluation of Computing Systems (ToMPECS), 2021. [Link]
- Mo Chen, Sylvia L. Herbert, Haimin Hu, Ye Pu, Jaime Fernández Fisac, Somil Bansal, SooJean Han, and Claire J. Tomlin. FaSTrack:A Modular Framework for Real-Time Motion Planning and Guaranteed Safe Tracking. *IEEE Transactions on Automatic Control*, 66(12):5861–5876, 2021. [Link]
- Shih-Hao Tseng, Carmen Amo Alonso, and SooJean Han. System level synthesis via dynamic programming. In *IEEE 59th Annual Conference on Decision and Control*, pages 1718–1725, 2020. [Link]
- Sylvia L. Herbert, Mo Chen, SooJean Han, Somil Bansal, Jaime F. Fisac, and Claire J. Tomlin. FaSTrack: A modular framework for fast and guaranteed safe motion planning. In *IEEE 56th Annual Conference on Decision and Control*, pages 1517–1522, 2017. [Link]

Papers in Preparation [Link to Papers available upon request.]

- SooJean Han and Soon-Jo Chung. Quantum Annealing for Iterative Traffic Flow Optimization over Vehicle Routes and Light Signals. To be submitted to American Controls Conference (ACC) 2022
- SooJean Han, Johanna Gustafson, and Soon-Jo Chung. Rule-Based Adaptive Control of an Isolated Intersection. To be submitted to American Controls Conference (ACC) 2022
- SooJean Han and Soon-Jo Chung. A Two-Part Controller Synthesis Approach for Nonlinear Stochastic Systems Perturbed by Lévy Noise Using Renewal Theory and HJB-Based Impulse Control. ArXiv, 2021. [Link]
- SooJean Han, Soon-Jo Chung, Shuyue Yu, and John C. Doyle. Modeling and Estimation of Epidemic Spread in Population Networks using Compartmental ODEs and Coupled Hidden Markov Models. To be submitted to SIAM Journal on Control and Optimization (SICON), 2022

- SooJean Han, Soon-Jo Chung, Shuyue Yu, and John C. Doyle. A New Insight Into the Modeling and Estimation of Epidemic Spread in Population Networks Using Compartmental ODEs and Hidden Markov Models. Submitted 2020 to SIAM Journal on Control and Optimization (SICON)

Lecture Notes [Link to Notes available upon request.]

- SooJean Han. Efficient Redundancy-Free Computation in Large-Scale Problems via Quantum Implementation of Machine Learning Approaches. 2022
- SooJean Han. Results from Renewal Theory and Martingale Theory. Preprint, 2022
- SooJean Han. A Survey of Approaches to Solving Pattern-Occurrence Problems. 2022
- SooJean Han. Methods of Filtering for Single and Multi-Sensor Data Fusion. 2021
- SooJean Han. Application of Girsanov's Theorem for Brownian Motion and Poisson Processes to Common Filtering Methods in Engineering. 2021
- SooJean Han. Notes on the Comparison Lemma and Various Forms of Gronwall's Inequality. 2021
- SooJean Han. Notes on Weak Convergence and the Skorokhod Topology. 2020
- SooJean Han. Stochastic Processes for Control Engineers. Preprint

Research & Teaching Experience

Summer Undergraduate Research Fellow (SURF) Mentor Jun-Sep 2022

Mentored a SURF student on a project about congestion control of vehicle traffic intersection networks via adaptive signals. Paper to be submitted to American Control Conference (ACC) 2022.

39th SoCal Control Workshop Apr 2022

Presented a controller framework for a class of discrete-time systems based on a novel principle called pattern-learning and prediction (PLP). PLP reduces computation redundancy and time by taking advantage of repeated patterns which occur in the underlying stochastic process. Slides can be found [here].

Teaching Assistant for Optimal Control and Estimation at Caltech Jan 2020 - Mar 2020

Provided lecture recitations and guest lectures on discrete and continuous-time Kalman filtering, particle filtering, the Hamilton-Jacobi-Bellman equation, and the Pontryagin Maximum Principle. Lecture notes I made for the course are available upon request.

Caltech CAST Poster Session Feb 2020

Presented a distributed data-gathering framework which uses processor-to-sensor feedback communication to reduce redundant data transmissions and sensor power consumption. Poster can be found [here].

Summer Internship at JPL Jun 2018 - Aug 2018

Worked on the DARPA Subterranean (SubT) Challenge under the supervision of Dr. Ali Agha as a part of Team CoSTAR. Implemented ORBSLAM using C/C++ and deployed it on terrestrial drones to perform distributed collaborative mapping and merging using keypoint feature detection.

Research Assistant at Caltech CAST Lab and SURF Mentor Jun 2017 - Aug 2017

Worked with Professor Soon-Jo Chung at the Caltech CAST Lab. Used ROS and the VICON motion capturing system for distributed control over multiple Crazyflie quadrotors for synchronization and formation-flying. PID and nonlinear controllers were implemented in Python and C++.

Undergraduate Research Assistant at UC Berkeley BAIR Lab Jan 2017 - May 2017

Worked in Professor Claire Tomlin's Hybrid Systems Laboratory. Developed and implemented obstacle detection on MATLAB for the FaSTrack algorithm. Relevant publications [here] and [here].