

Sarah H.Q. Li

PhD Candidate in Aeronautics and Astronautics

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Research Interest. My goal is to realize **large-scale autonomy** in disruption-prone and resource uncertain environments, such as urban air mobility, roadways, and satellite constellations. I combine optimization, game theory, and control theory to provably facilitate autonomous coordination for fleets of vehicles, aircraft, and spacecraft.

Education



University of Washington. Seattle, USA.

Ph.D. in Aeronautics and Astronautics Engineering,

MS in Aeronautics and Astronautics Engineering,

Advisors: [Behçet Açıkmeşe](#), [Pierre-Loic Garoche](#)

Expected March 2023

March 2021



University of British Columbia, Vancouver, Canada.

B.A.Sc in Engineering Physics, Minor in Honours Mathematics.

Advisor: [Elizabeth Croft](#)

May 2017

Awards & Fellowships

- Condit Graduate Fellowship in Aeronautics and Astronautics (top graduating Ph.D. student each year). 2022
- Cyber-physical Systems Rising Star (~ 50 Ph.D. students in the US each year). 2022
- Aerospace Engineering Rising Star (~ 30 Ph.D. students in the US each year). 2022
- Zonta International Amelia Earhart Fellowship (up to 35 recipients globally each year). 2020
- Outstanding Female Engineer Award, University of Washington Society of Women Engineers. 2020
- Student Travel Award, IEEE Conference on Decision and Control 2019
- UW Aeronautics & Astronautics Top Scholar Award (one Ph.D. student each year). 2017
- UBC John Collison Memorial Scholarship in Mathematics (one undergraduate student each year). 2015
- Loran Provincial Scholar (Awarded to one high school student provincially each year). 2011
- President's Entrance Scholarship and Major Entrance Scholarship, University of British Columbia. 2011

Research Internships & Visits

Visiting Researcher at **École Nationale de l'Aviation Civile (ENAC)** 09/2021 - 07/2022

Design a congestion game model for real-time tactical air traffic management.

Research Intern at **Microsoft Research, Redmond** 06/2021 - 09/2021

Inspired by supply chains, explore the effect of information availability in multi-agent reinforcement learning.

System Engineering Intern at **Loon, an Alphabet company** 05/2020 - 09/2020

Develop data-driven multi-objective optimization algorithms for designing stratospheric balloons. Conduct wind tunnel tests to evaluate the aerodynamic performance of next-gen balloons.

Visiting Researcher at **ONERA, the French Aerospace Lab** 09/2019 - 10/2019

Use fixed point analysis to address parameter-uncertainty Markov decision processes.

Research Intern at **University of British Columbia** 02/2017 - 08/2017

Develop augmented-reality-based trajectory planning for industrial robotics via Microsoft HoloLens.

Mentoring & Teaching

Teaching Assistant 03/2019 - 06/2019

AA 447 - Control In Aerospace Systems, University of Washington

Project Advisor

03/2022 - 06/2022

AA 322 - Aerospace Laboratory II (Lab), University of Washington

Peer Research Advising

2019-2022

- Nicolas Miguel (undergraduate, now Ph.D. student at Purdue). Publication: [J4]
- Avi Mittal (undergraduate, now intern at Starfish Inc.). Publication: [J1]
- Jason Zhou (undergraduate, now intern at Tesla).
- Natalia Pavlasek (graduate student at the University of Washington)

Services

- President, UW Women in Aero&Astro 2022
- Member, UW Women in Aero&Astro 2019-2022
- UW Aeronautics and Astronautics Faculty Search Committee Student Representative 2020-2021
- Volunteer at University District Food Bank and University of Washington Farm 2018-2019
- Sergeant-At-Arms, Walter Gage Toastmasters Club 2016
- Radio DJ, CFUV 101.9 FM Victoria, Canada 2010-2011

Conference Reviewer: IEEE American Control Conference (ACC), IEEE Conference on Control Technology and Applications (CCTA), IEEE Conference on Decision and Control (CDC), Learning for Dynamics and Control Conference (L4DC), IFAC Conference on Networked Systems (NECSYS).

Journal Reviewer: Automatica, IEEE Control System Letters (L-CSS), IEEE Transactions on Automatic Control (TAC), IEEE Transactions on Control and Networked Systems (TCNS), IEEE Transactions on Aerospace and Electronic Systems.

Publications & Intellectual Property*Journals*

- [J1] **Congestion Game Model for Aircraft Re-routing in Unpredictable Airspaces.**
S.H.Q. Li, P. Garoche, D. Delahaye, B. Açıkmeşe.
in preparation
- [J2] **Set-based Value Operators for Non-Stationary and Uncertain Markov Decision Processes.**
S.H.Q. Li, A. Adjé, P. Garoche, B. Açıkmeşe.
under review for Automatica
- [J3] **Revisiting Disturbance Decoupling with an Optimization Perspective.**
S. B. Sarsilmaz, S.H.Q. Li, B. Açıkmeşe.
under review for System & Control Letters
- [J4] **Adaptive Constraint Satisfaction for MDP Congestion Games: Application to Transportation Networks.**
S.H.Q. Li, Y. Yu, D. Calderone, N. Miguel, L. J. Ratliff, B. Açıkmeşe.
provisionally accepted for Automatica
- [J5] **Congestion-aware path coordination game with Markov decision process dynamics.**
S.H.Q. Li, D. Calderone, B. Açıkmeşe.
2022 IEEE Control System Letters (L-CSS)
- [J6] **A Primal-Dual Approach to Markovian Network Optimization.**
Y. Yu, D. Calderone, S.H.Q. Li, L. J. Ratliff, B. Açıkmeşe.
2022 Automatica
- [J7] **Bounding Fixed Points of Set-based Bellman Operator and Nash Equilibria of Stochastic Games.**
S.H.Q. Li, A. Adjé, P. Garoche, B. Açıkmeşe.
2020 Automatica
- [J8] **Disturbance Decoupling For Gradient-based Multi-Agent Learning with Quadratic Costs.**
S.H.Q. Li, L. J. Ratliff, B. Açıkmeşe.
2020 IEEE Control System Letters (L-CSS)

Peer-Reviewed Conference/Magazine Publications

- [C1] **Re-Inventing the Food Supply Chain with IoT: A Data-Driven Solution to Reduce Food Loss.**
V. Ranganathan, P. Kumar, U. Kaur, **S.H.Q. Li**, T. Chakraborty, R. Chandra.
2022 IEEE Internet of Things Magazine
- [C2] **Fixed Points of Set-based Bellman Operator.**
S.H.Q. Li, A. Adjé, P. Garoche, B. Açıkmeşe.
2020 International Federation of Automatic Control (IFAC) World Congress
- [C3] **Sensitivity Analysis for Markov Decision Process Congestion Games.**
S.H.Q. Li, D. Calderone, L.J. Ratliff, B. Açıkmeşe.
2019 IEEE Conference on Decision and Control (CDC)
- [C4] **Tolling for Constraint Satisfaction in Markov Decision Process Congestion Games.**
S.H.Q. Li, Y. Yu, D. Calderone, L.J. Ratliff, B. Açıkmeşe.
2019 IEEE American Control Conference (ACC)
- [C5] **Robot Programming through Augmented Trajectories in Augmented Reality.**
C.P. Quintero, **S.H.Q. Li**, M.K.X.J. Pan, W.P. Chan, H.F. M. Van der Loos, E. Croft.
2018 IEEE International Conference on Intelligent Robots and Systems (IROS)
- [C6] **Schematic Driven Silicon Photonics Design.**
L. Chrostowski, Z. Lu, J. Flückiger, J. Pond, J. Klein, X. Wang, **S.H.Q. Li**, W. Tai, C. Kim, J. Ferguson, C. Cone.
2016 Smart Photonic and Optoelectronic Integrated Circuits (SPIE) Proceedings

Peer-Reviewed Workshops

- [W1] **Collision Risk-based Congestion Game For Air Traffic Management.**
S.H.Q. Li, A. Mittal, P.-L. Loic, B. Açıkmeşe.
2022 Workshop on Strategic Multi-Agent Interactions for Conference on Robot Learning (CoRL)
- [W2] **Stochastic Supply Chain Games with Networked Information Flow.**
S.H.Q. Li, L.J. Ratliff, P. Kumar.
2022 Workshop on Gamification and Multiagent Solutions for International Conference on Learning Representations (ICLR)
- [W3] **Robot programming through augmented trajectories.**
C.P. Quintero, **S.H.Q. Li**, C. Shing, W.P. Chan, S. Sheikholeslami, H.F.M. Van der Loos, E. Croft.
2018 Workshop on Virtual, Augmented, and Mixed Reality for Human-Robot Interaction (HRI)
- [W4] **CAD-AR: An Intuitive Robotic Teaching Pendant for Skill-based Industrial Robot Programming.**
S.H.Q. Li, C. Shing, Y. Coady, H.F.M. Van der Loos, E. Croft.
2017 IEEE International Conference on Intelligent Robots and Systems (IROS) Workshop

Intellectual Property

- [I1] **Reinforcement Learning Simulation of Supply Chain Graph.**
P. Kumar, **S.H.Q. Li**, V. Ranganathan, L. J. Ratliff, R. Chandra, V. Jain, M. Bassani, J. Reynolds.
under review | Indian Patent Office 202141048296.

Undergraduate Internships

- Firmware Intern at **Zaber Technologies Inc.** 05/2016 – 12/2016
Develop high-precision feedback controllers with C++ on STM32 ARM MCU's for stepper/linear/servo actuators.
- Research Intern at **Deutsches Elektronen Synchrotron (DESY)** 07/2015 – 08/2015
Optimize data transfer speed on the Compact Muon Solenoid Detector in CERN's Large Hadron Collider (LHC)
- Software Intern at **Macdonald, Dettwiler and Associates (MDA)** 05/2014 – 12/2014
Develop the scheduling algorithm for the RADAR-SAT Constellation Mission satellites using C++ and PostgreSQL.
- Software Intern at **3vGeomatics** 01/2013 – 04/2013
Optimize the visualization of millions of Synthetic-Aperture Radar (SAR) data points in Google Maps.

Invited Talks

[T1] <i>Seminar Talk</i> , ETH Zurich, Automatic Control Laboratory	11/2022
[T2] <i>Automated Intralogistics Innovations</i> , INFORMS 2022	10/2022
[T3] <i>Autonomous Talks</i> , ETH Zurich, Institute for Dynamic Systems and Control	10/2022
[T4] <i>Seminar Talk</i> , CU Colorado, Autonomous Decision and Control Laboratory	10/2022
[T5] <i>Seminar Talk</i> , EPFL	06/2022
[T6] <i>Rising Stars</i> , University of Colorado, Boulder	05/2022
[T7] <i>Biotech Day</i> , W.F. West High School	05/2022
[T8] <i>Seminar Talk</i> , Oden Institute, University of Texas, Austin	03/2022
[T9] <i>Conference Talk</i> , Zonta International District 8 Fall Conference	10/2021
[T10] <i>Semiautonomous Seminar</i> , UC Berkeley	09/2021
[T11] <i>Reinforcement Learning Reading Group</i> , Microsoft Research, Redmond	09/2021
[T12] <i>Coffee talk</i> , Advanced Concepts Team, European Space Agency	03/2021
[T13] <i>Guest lecture</i> , EE 546: Optimization and Learning for Control	02/2020
[T14] <i>Poster Talk</i> , NSF Smart and Connected Communities (S&CC).	04/2019

Additionally, all first-authored conference/workshop papers were invited talks at the corresponding conference.

References

- **Behçet Açıkmеше**
Professor, University of Washington, Aeronautics and Astronautics Engineering
behcet@uw.edu
- **Pierre-Loic Garoche**
Professor, École Nationale de l'Aviation Civile
pierre-loic.garoche@enac.fr
- **Lillian Ratliff**
Associate Professor, University of Washington, Electrical and Computer Engineering
ratliff@uw.edu
- **Mehran Mesbahi**
Professor, University of Washington, Aeronautics and Astronautics Engineering
mesbahi@aa.washington.edu
- **Kristi Morgansen**
Professor and Department Chair, University of Washington, Aeronautics and Astronautics Engineering
morgansn@uw.edu
- **Ufuk Topcu**
Associate Professor University of Texas, Austin, Aerospace Engineering and Engineering Mechanics
utopcu@utexas.edu