Sarah H.Q. Li

PhD Candidate in Aeronautics and Astronautics sarahli@uw.edu | sarahli.netlify.app

Research Interest. My goal is to realize **large-scale autonomy** in disruption-prone and human-interactive settings such as urban air mobility, roadways, and automated warehouses. I combine optimization, game theory, and control theory to provably facilitate autonomy in existing and upcoming urban and aeronautical infrastructure.

Education

University of Washington. Seattle, USA.
Ph.D. in Aeronautics and Astronautics Engineering, **Expected January 2023**
MS in Aeronautics and Astronautics Engineering, **March 2021**
Advisors: Behçet Açıkmeşe, P-L Garoche

University of British Columbia, Vancouver, Canada.
B.A.Sc in Engineering Physics, Minor in Honours Mathematics. **May 2017**
Advisor: Elizabeth Croft

Awards & Fellowships

- Condit Graduate Fellowship in Aeronautics and Astronautics (top graduating Ph.D. student each year). **2022**
- Cyber-physical Systems Rising Star ($\sim$ 50 Ph.D. students in the US each year). **2022**
- Aerospace Engineering Rising Star ($\sim$ 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

Undergraduate Research Advising 2019-2022
- Nicolas Miguel (now Ph.D. student at Purdue). Publication: [J4]
- Avi Mittal (now intern at Starfish Inc.).
- Jason Zhou (now intern at Tesla).

Services

- 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).

Publications

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 Markovian Environments.**
S.H.Q. Li, A. Adjé, P. Garoche, B. Açıkmeşe.
under review for Automatica

[J3] **Revisiting Disturbance Decoupling with an Optimization Perspective.**
S. B. Sarslmaz, **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] **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 ICLR

[W2] **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 HRI

[W3] **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 Properties

[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] *Seminar Talk*, EPFL **06/2022**
Scalable multi-robot trajectory planning under stochastic demands.

[T2] *Rising Stars*, University of Colorado, Boulder **05/2022**
Architecting co-existence: scalable integration of autonomy in shared spaces..

[T3] *Biotech Day*, W.F. West High School **05/2022**
The game of life: how game theory affects our everyday lives.

[T4] *Seminar Talk,* Oden Institute, University of Texas, Austin **03/2022**
Non-cooperative decision-making in cyber-physical systems: optimality, sensitivity, and robustness.

[T5] *Conference Talk,* Zonta International District 8 Fall Conference **10/2021**
Regulating and predicting societal-level behavior of autonomous multi-agent systems.

[T6] *Semiautonomous Seminar,* UC Berkeley **09/2021**
Adaptive Constraint Satisfaction for MDP Congestion Games: Application to Transportation Networks.

[T7] *Reinforcement Learning Reading Group*, Microsoft Research, Redmond **09/2021**
Information-Sharing in Actor-Critic Games: Application to Supply Chain Networks.

[T8] *Coffee talk*, Advanced Concepts Team, European Space Agency **03/2021**
Incentivizing autonomous vehicles and spacecraft toward constraint satisfaction.

[T9] *Guest lecture*, EE 546: Optimization and Learning for Control **02/2020**
Set-based dynamic programming for robust Markov decision processes.

[T10] *Poster Talk*, NSF Smart and Connected Communities (S&CC). **04/2019**
Markovian Network Equilibrium.

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

References

- **Behçet Açıkmeşe**
  Professor, University of Washington, Aeronautics and Astronautics Engineering
  behcet@uw.edu
- **P-L Garoche**
  Professor, École Nationale de l'Aviation Civile
  pierre-loic.garoche@enac.fr
- **Lillian Ratliff**
  Associate Professor, University of Washington, Electrical and Computer Engineering
  ratliffl@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