Shadi Haddad

PhD Candidate · Applied Mathematics

Santa Cruz, CA

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Education

University of California, Santa Cruz — Santa Cruz, CA

PhD in Applied Mathematics — *Expected graduation in Dec 2023*

- Applied Mathematics Research Award (2022)
- Chancellor's Fellowship (2019)

University of Tehran, College of Mechanical Engineering — Tehran, Iran

M.Sc. in Mechanical Engineering — *January 2018*

- Thesis: "Second Order Sliding Mode Tracking Control of a Piezoelectric Tapered Micro Actuator with Axial Deflection and System Nonlinearity"
- Full Tuition Merit Scholarship

Chamran University of Ahvaz, College of Mechanical Engineering — Ahvaz, Iran

B.Sc. in Mechanical Engineering — *July 2015*

- Full Tuition Merit Scholarship

Work & Research

Graduate Student Researcher with the University of California at Santa Cruz — Santa Cruz, CA

2019-Present

- Optimization for control and machine learning
- Set-based reachability analysis
- Stochastic control and model predictive control

Teaching Assistant with the University of California at Santa Cruz

(2020-2023)

- Convex optimization
- Introduction to dynamical systems
- Mathematical methods for engineering II

Graduate Student Researcher with the University of Tehran — Tehran, Iran

2015-2018

- Micro-beam mechanical design and vibration control

Expertise and Skills

- Optimization and Semidefinite Programming (SDP), Machine Learning (ML)
- Optimal Control, Stochastic Control, Model Predictive Control (MPC)
- Reachability Analysis

Programming

- MATLAB and Simulink, CVX, Python, Data Structure, Matplotlib, TensorFlow, MAPLE, C++, Numerical Methods, Physical Simulations, Scientific Visualization

Engineering, Modelling, and Simulation

- SOLIDWORKS, ABAQUS

Technical Writing and Documentation

- LaTeX, Jupyter Notebook, Keynote

Publications

Exact Computation of LTI Reach Set from Integrator Reach Set with Bounded Input.
Shadi Haddad, Pansie Khodary, Abhishek Halder. *arXiv:2309.08222*, 2023.

The Curious Case of Integrator Reach Sets, Part I: Basic Theory.
Shadi Haddad, Abhishek Halder. *IEEE Transactions on Automatic Control*, 2023.

Convex and Nonconvex Sublinear Regression with Application to Data-driven Learning of Reach Sets.
Shadi Haddad, Abhishek Halder. *American Control Conference*, 2023.

Hausdorff Distance between Norm Balls and their Linear Maps.
Shadi Haddad, Abhishek Halder. *Set-Valued and Variational Analysis*, 2023.

Certifying the Intersection of Reach Sets of Integrator Agents with Set-valued Input Uncertainties.
Shadi Haddad, Abhishek Halder. *IEEE Control Systems Letters*, 2022.

Density-Based Stochastic Reachability Computation for Occupancy Prediction in Automated Driving.
Shadi Haddad, Abhishek Halder, and Baljeet Singh. *IEEE Transactions on Control Systems Technology*, 2022.

Boundary and Taxonomy of Integrator Reach Sets.
Shadi Haddad, Abhishek Halder. *American Control Conference*, 2022.

Anytime Ellipsoidal Over-approximation of Forward Reach Sets of Uncertain Linear Systems.
Shadi Haddad, Abhishek Halder. *CPS IoT Week Workshop*, 2021.

Prediction and Optimal Feedback Steering of Probability Density Functions for Safe Automated Driving.
Shadi Haddad, Kenneth F Caluya, Abhishek Halder, Baljeet Singh. *IEEE Control Systems Letters*, 2020.

The Convex Geometry of Integrator Reach Sets.
Shadi Haddad, Abhishek Halder. *American Control Conference*, 2020.

Observer Based Fault Reconstruction Schemes Using Terminal Sliding Modes.
M. Mousavi, M. Rahnavard, SHaddad. *International Journal of Control*, 2018.

Analytical Study on Nonlinear 3D Coupled Deformations of Tapered FG Micro-beams Accounting for Size Effects.
S. Haddad, M. Baghani. *Iranian Journal of Science and Technology*, 2018.

Talks and Presentations

American Control Conference — San Diego, CA, 2023
"Convex and Nonconvex Sublinear Regression with Application to Data-driven Learning of Reach Sets "

IEEE Conference on Decision and Control — Cancún, Mexico, 2022
"Certifying the Intersection of Reach Sets of Integrator Agents with Set-valued Input Uncertainties "

American Control Conference — Atlanta, GA, 2022
"Boundary and Taxonomy of Integrator Reach Sets"

American Control Conference — Virtual, 2021
"Prediction and Optimal Feedback Steering of Probability Density Functions for Safe Automated Driving"

3rd NorCal Control Workshop — Virtual,2021
"The Convex Geometry of Integrator Reach Sets"

American Control Conference — Virtual, 2020
"The Convex Geometry of Integrator Reach Sets"

Bay Area Robotics Symposium — University of California at Berkeley, 2019
"Understanding the Geometry of Integrator Reach Sets for Robotics Applications"

Professional Activities

2023 **Reviewer for IEEE Control Systems Letters**
2023 **Reviewer for Journal of Systems and Control Letters**
2023 **Reviewer for Journal of Optimization Theory and Applications**
2023 **Reviewer for 2023 American Control Conference**
2022 **Reviewer for 2022 IEEE Conference on Decision and Control**
2022 **Reviewer for 2022 American Control Conference**
2021 **Reviewer for 2021 IEEE Control Systems Letters**
2021 **Reviewer for 2021 IEEE Conference on Decision and Control**
2021 **Reviewer for 2021 CPS IoT Week Workshop on Computation-Aware Algorithmic Design for Cyber-Physical Systems**
2020 **Reviewer for 2020 IEEE Conference on Decision and Control**

Honors & Awards

2022 **Applied Mathematics Research Award**, University of California at Santa Cruz *Santa Cruz, CA*
2022 **Student Travel Award**, IEEE Control Systems Society, American Control Conference *Atlanta, GA*
2022 **Advancement to Ph.D Candidacy with Honors**, University of California at Santa Cruz *Santa Cruz, CA*
2021 **Student Travel Award**, IEEE Control Systems Society, American Control Conference *New Orleans, LA (Virtual)*
2020 **Student Travel Award**, IEEE Control Systems Society, American Control Conference *Denver, CO (Virtual)*
2019 **Chancellor's Fellowship**, University of California at Santa Cruz *Santa Cruz, CA*
2015 **Full Tuition Merit Scholarship**, University of Tehran *Tehran, Iran*
2011 **Full Tuition Merit Scholarship**, Chamran University of Ahvaz *Ahvaz, Iran*

Selected Graduate Courses

Machine Learning, Convex Optimization, Nonlinear Control Theory, Applied Optimal Control, *UC Santa Cruz*
Finite Element Method *University of Tehran*