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 Aug 2023*

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

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

- Convex optimization — *Fall 2022*
- Introduction to Dynamical Systems — *Fall 2021*
- Mathematical Methods for Engineering II — *Winter 2021*

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, LabVIEW

Technical Writing and Documentation

- LaTeX, Jupyter Notebook, Keynote

Publications

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
arXiv:2206.12012
2022

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, S. Haddad
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

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

American Control Conference
Atlanta, GA
Journal Paper and Conference Talk
2022
"Boundary and Taxonomy of Integrator Reach Sets"

American Control Conference
Virtual
Journal Paper and Conference Talk
2021
"Prediction and Optimal Feedback Steering of Probability Density Functions for Safe Automated Driving"

3rd NorCal Control Workshop
Virtual
Conference Talk
2021
"The Convex Geometry of Integrator Reach Sets"

American Control Conference
Virtual
Conference Paper and Talk
2020
"The Convex Geometry of Integrator Reach Sets"

Bay Area Robotics Symposium
University of California at Berkeley
Spotlight Talk and Poster Presentation
2019
"Understanding the Geometry of Integrator Reach Sets for Robotics Applications"

Professional Activities

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*