

Hasan A. Poonawala

Title: Assistant Professor, Mechanical & Aerospace Engineering, University of Kentucky
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Education

Ph.D.	Electrical Engineering	University of Texas at Dallas, Richardson, TX	May 2014
M.S.	Mechanical Engineering	University of Michigan, Ann Arbor, MI	Dec 2009
B. Tech.	Mechanical Engineering	National Institute of Technology, Surathkal, India	May 2007

Professional Appointments

2018 – Present: Assistant Professor, Mechanical Engineering, University of Kentucky.
2015 – 2018: Postdoctoral Fellow, ICES, University of Texas, Austin.
2014 – 2015: Postdoctoral Researcher, Electrical Engineering, University of Texas at Dallas.
2010 – 2014: Research Assistant, Electrical Engineering, University of Texas at Dallas
2010 – 2010: Research Assistant, Mechanical Engineering, University of Michigan
2007 – 2008: Research Assistant, Aerospace Engineering, Indian Institute of Science, Bangalore.

Research Experience

2018 - Assistant Professor

Present. *Mechanical & Aerospace Engineering, University of Kentucky*

- Lead a research team consisting of multiple graduate and undergraduate students in areas of robot control and machine learning.
- Develop optimization-based tools using for synthesis of neural-network controllers.
- Supervise research on real-time versions of RRT* that handle moving obstacles and changing goals for 7 DoF robot arms.
- Supervise development of edge-machine learning systems that enable human, robot, and object pose tracking for intuitive robot motion training.

2015 - Postdoctoral Fellow

2018. *Institute For Computational Sciences & Engineering, University of Texas, Austin.*

- Analysis of controllers designed using machine learning and data.
- Planning under uncertainty for spacecraft rendezvous and docking.
- Probabilistic verification for motion planning using convex optimization.
- Robust control of brain-computer interfaces.

2014 - Postdoctoral Researcher

2015. *Electrical Engineering, University of Texas at Dallas*

- Developed novel prosthetic gait control mechanisms used by several labs today.
- Developed time optimal feedback control laws for wheeled mobile robots.

2010 - Research Assistant

2014. *Electrical Engineering, University of Texas at Dallas*

- Developed and implemented coordination control mechanisms for multiple robots with heterogenous sensor and communication capabilities.
- Developed and implemented vision-based mobile robot navigation controllers in C++.
- Developed and validated quadrotor controllers robust to modeling errors.

- 2010 **Researcher Assistant**
Mechanical Engineering, University of Michigan
- Developed stride-length estimation algorithms for prosthetics.
- 2008 - **Mechatronics Engineer**
2009. *Mechanical Engineering, University of Michigan*
- Developed turnkey mechatronic system for infant development research (fabricated joystick, provide real-time video feedback based on encoder reading).
 - Maintained and developed equipment for Mechatronics Lab
- 2007 - **Research Assistant**
2008. *Aerospace Engineering, Indian Institute of Science, Bangalore, India*
- Design of a light-weight quadrotor using composite materials.
 - Refraction angle compensation for sensors in guidance systems

Teaching Experience

- Fall 2022 ME 310 Engineering Experimentation I.
Dept. of Mechanical Engineering, University of Kentucky, Lexington, KY
Role: **Instructor**
- Spring 2022 ME 340 Introduction to Mechanical Systems.
(& F20, F19) Dept. of Mechanical Engineering, University of Kentucky, Lexington, KY
Role: **Instructor**
- Spring 2021 ME 676 Robot Modeling & Control.
(& S20, S19) Dept. of Mechanical Engineering, University of Kentucky, Lexington, KY
Role: **Instructor**
- Spring 2015 Systems and Controls Laboratory.
Dept. of Mechanical Engineering, University of Texas at Dallas, Richardson, TX
Role: **Instructor**
- Spring 2014 Nonlinear Control Systems.
Dept. of Electrical Engineering, University of Texas at Dallas, Richardson, TX
Role: **Teaching Assistant**
- Fall 2013 Dynamics of Complex Networks & Systems
Dept. of Systems Management, University of Texas at Dallas, Richardson, TX
Role: **Teaching Assistant**

Grant Funding

1. EAGER: Robust Data-Driven Robotic Manipulation via Bayesian Inference and Passivity-Based Control, Agency: **NSF**, Amount: \$292,193, Period: 8/1/23-7/31/25, **PI**.
2. Vision-Based Collision Avoidance For Robot Arms, Agency: **QMI Robotics** (DoD SBIR), Amount: \$20,055, Period: 2/1/21-3/22/21, **PI**.
3. Developing an Artificially Intelligent (AI) Coach for Reducing Sedentary Habits, UKY, Amount: \$28,264, Period: 0/1/21-7/31/21, **PI**.
4. AI-Enabled Discovery and Physics-Based Optimization of Energy-Efficient Processing Strategies for Advanced Turbine Alloys, Agency: **Dept. of Energy**, Amount: \$499,799, Period: 5/15/20-4/14/22, Co-PI (Share: 40%).
5. Multi-scale data driven modeling of radiative transport through thermal protection systems, Agency: **NASA**, Amount: \$645,098, Period: 8/1/22-7/31/25, Co-I (Share: 20%).

6. Development of an artificial neural network to transfer microstructural information of thermal protection systems (TPS) into vehicle-scale simulations, Agency: **NASA**, Amount: \$90,000, Period: 8/1/20-12/31/22, Co-I (Share: 50%).
7. Next Generation Materials and Processing Technologies (NextGen MatProTech), Agency: **Army Research Labs**, Amount: \$23,838,327, Period: 10/1/20-9/30/25, Co-I (Share: 1%).

Journal Publications

1. P. Samanipour and H. A. Poonawala, "Stability Analysis and Controller Synthesis using Single-hidden-layer ReLU Neural Networks," in *IEEE Transactions on Automatic Control*, doi: 10.1109/TAC.2023.3270219.
2. Badings, T. S., Romao, L., Abate, A., Parker, D., Poonawala, H. A., Stoelinga, M., and Jansen, N. 2023. "Robust Control for Dynamical Systems with Non-Gaussian Noise via Formal Abstractions." *J. Artificial Intelligence Res.*, 76 (May 2023). <https://doi.org/10.1613/jair.1.14253>.
3. Julius Schoop, Hasan A. Poonawala, David Adeniji, and Benton Clark. "AI-enabled dynamic finish machining optimization for sustained surface integrity." *Manufacturing Letters* 29 (2021): 42-46, DOI: 10.1016/j.mfglet.2021.04.002.
4. Jonathan Fugal, Jihye Bae, and Hasan A. Poonawala. "On the Impact of Gravity Compensation on Reinforcement Learning in Goal-Reaching Tasks For Robotic Manipulators." *Robotics* 10, no. 1 (2021): 46, DOI:10.3390/robotics10010046.
5. H. A. Poonawala, "Stability Analysis of Conewise Affine Dynamical Systems Using Conewise Linear Lyapunov Functions," in *IEEE Control Systems Letters*, vol. 5, no. 6, pp. 2126-2131, Dec. 2021, DOI: 10.1109/LCSYS.2020.3046702.
6. H. A. Poonawala, Niklas Lauffer, and Ufuk Topcu. "Training classifiers for feedback control with safety in mind." *Automatica* 128 (2021): 109509, DOI: 10.1016/j.automatica.2021.109509
7. H. A. Poonawala and Mark W. Spong, "Time-optimal velocity tracking control for differential drive robots." *Automatica*, 85:153-157, 2017.
8. H. A. Poonawala and M. W. Spong. "Preserving Strong Connectivity in Directed Proximity Graphs." *IEEE Transactions on Automatic Control*, 62(9):4392-4404, Sept 2017.
9. H. A. Poonawala and Mark W. Spong, "Cooperative Visibility Maintenance in SE(3) for Multi-Robot-Networks with Limited Field-of-View Sensors," In *Control Theory and Technology*, vol 15, 246-257 (2017) DOI: 10.1007/s11768-017-7096-8.
10. D. J. Villarreal, H. A. Poonawala, and R. D. Gregg. "A Robust Parameterization of Human Gait Patterns Across Phase-Shifting Perturbations." *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, PP(99):1-1, 2017.
11. H. A. Poonawala, A. C. Satici, and M. W. Spong. "Collision-free formation control with decentralized connectivity preservation for nonholonomic-wheeled mobile robots." *IEEE Transactions on Control of Network Systems*, 2(2):122-130, June 2015.
12. A. C. Satici, H. A. Poonawala, and M. W. Spong. Robust Optimal Control of Quadrotor UAVs. *IEEE Access*, 1:79-93, 2013.

Conference Publications

1. B. Clark, V. Hariprasad, and H. A. Poonawala, "Provably Correct Sensor-driven Path-following for Unicycles using Monotonic Score Functions", 2023 *IEEE/RSJ International Conference on Intelligent Robots and Systems*.
2. Samanipour; P.; Poonawala, H.A.;, "Automated Stability Analysis of Piecewise Affine Dynamics Using Vertices", *Allerton Conference*, 2023.

3. Badings, T.S., Abate, A., Jansen, N., Parker, D., Poonawala, H.A. and Stoelinga, M., "Sampling-based robust control of autonomous systems with non-Gaussian noise", *2022 AAAI Conference on Artificial Intelligence*.
4. H. A. Poonawala, "Stability Analysis of Conewise Affine Dynamical Systems Using Conewise Linear Lyapunov Functions," *American Control Conference (ACC)*, 2021, pp. 2406-2411, DOI: 10.23919/ACC50511.2021.9483040.
5. H. A. Poonawala, "Stability Analysis Via Refinement Of Piece-wise Linear Lyapunov Functions," *2019 IEEE 58th Conference on Decision and Control (CDC)*, 2019, pp. 1442-1447, DOI: 10.1109/CDC40024.2019.9030067.
6. Suda Bharadwaj, Steven Carr, Natasha Neogi, Hasan Poonawala, Alejandro Barberia Chueca, and Ufuk Topcu, "Traffic management for urban air mobility," In *NASA Formal Methods*, pages 71–87, Cham, 2019. Springer International Publishing.
7. H. A. Poonawala, N. Lauffer, and U. Topcu, "Training classifiers for feedback control," In *2019 American Control Conference (ACC)*, pages 4961–4967, July 2019.
8. H. A. Poonawala and U. Topcu, "Robustness of classifier-in-the-loop control systems: A hybrid-systems approach," In *2017 IEEE 56th Annual Conference on Decision and Control (CDC)*, pages 2738–2743, Dec 2017.
9. Murat Cubuktepe, Nils Jansen, Sebastian Junges, Joost-Pieter Katoen, Ivan Papusha, Hasan A. Poonawala, and Ufuk Topcu. "Sequential Convex Programming for the Efficient Verification of Parametric MDPs," In *Tools and Algorithms for the Construction and Analysis of Systems (TACAS)*, 2017.
10. H. A. Poonawala and M. W. Spong. On maintaining visibility in multi-robot- networks with limited field-of-view sensors. In *2017 American Control Conference (ACC)*, pages 4983-4988, May 2017.
11. H. A. Poonawala and U. Topcu. Filter-based stochastic abstractions for constrained planning with limited sensing. In *2016 IEEE 55th Conference on Decision and Control (CDC)*, pages 3319-3324, Dec 2016.
12. Hasan A. Poonawala and Mark W. Spong. From nonholonomy to holonomy: Time-optimal velocity control of differential drive robots. In *Robot Motion and Control (RoMoCo)*, 2015 10th International Workshop on, pages 97-102, July 2015.
13. Hasan A. Poonawala and Mark W. Spong. Decentralized estimation of the algebraic connectivity for strongly connected networks. In *2015 American Control Conference (ACC)*, pages 4068-4073, July 2015.
14. Aykut C. Satici, Hasan A. Poonawala, Hazen Eckert, and Mark W. Spong. Connectivity preserving formation control with collision avoidance for nonholonomic wheeled mobile robots. In *2013 IEEE/RSJ International Conference on Intelligent Robots and Systems*, pages 5080-5086, Nov 2013.
15. Hasan A. Poonawala, Aykut C. Satici, and Mark W. Spong. Leader-follower formation control of nonholonomic wheeled mobile robots using only position measurements. In *2013 9th Asian Control Conference (ASCC)*, pages 1-6, June 2013.
16. Hasan A. Poonawala, Aykut C. Satici, Nicholas Gans, and Mark W. Spong. Formation control of wheeled robots with vision-based position measurement. In *American Control Conference (ACC)*, 2012, pages 3173-3178, june 2012.
17. Hasan Poonawala and Debasish Ghose. Refraction angle compensation with tracking applications. In *International conference on Avionics Systems*, 2008.
18. Hasan Poonawala, K.N. Krishnanand, and D. Ghose. Design of a quadrotor micro air vehicle. In *Conference on Advances in Space Science and Technology*, 2007.

Talks

Oct 2022	“Data-Driven Control & Decision Making”	Lexmark AI Seminar Series.
May 2021	“Stability Analysis of Conewise Affine Dynamical Systems Using Conewise Linear Lyapunov Functions”	2021 American Control Conference.
Aug 2020	“Machine Learning For Model-based Feedback Control Of Robot Motion”	University of Cincinnati (virtual).
Feb 2020	“Machine Learning and Robot Motion Control”	Centre College, Danville, Kentucky.
Dec 2019	“Stability analysis via refinement of piece-wise linear lyapunov functions”	2019 IEEE Conference on Decision and Control.
Sep 2019	“Training Classifiers For Control Using Unreliable Data”	2019 Allerton Conference.
July 2019	“Training classifiers for feedback control”	2019 American Control Conference.

Professional Service

Conference Organization

1. Associate Editor, 2024 IEEE Intl. Conference on Robotics and Automation
2. Workshop Organizing Committee, 2023 IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems
3. Workshop Organizing Committee, 2022 IEEE Intl. Conference on Robotics and Automation
4. Program Committee, 2020 Intl. Conf. on Formal Modeling and Analysis of Timed Systems
5. Associate Editor, 2020 IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems

Journal Reviewer

1. IFAC Automatica
2. IEEE Transactions on Automatic Control
3. IEEE Transactions on Control of Networked Systems
4. IEEE Robotics & Automation Letters
5. IEEE Sensors
6. IEEE Control Systems Letters
7. Journal of the Franklin Institute
8. Robotics and Computer Integrated Manufacturing

Conference Reviewer

1. IFAC American Control Conference
2. IEEE Control and Decision Conference
3. International Conference on Learning and Representation
4. IEEE International Conference on Robotics & Automation
5. IEEE/RSJ International Conference on Intelligent Robots and Systems
6. ML4PS NeurIPS Workshop
7. International Conference on Formal Modeling and Analysis of Timed Systems(FORMATS)

University Service

1. 2022-Present, Faculty Advisor, ASME Student’s Chapter
2. 2019-Present, Member of the ME Controls Committee
3. Spring 2021, Organized TASK Space, a robotics discussion forum at UK
4. 2020-2021, Member of the ME Policies Committee
5. 2019-2020, Member of the ME Graduate Studies Committee
6. Spring 2019, Member of the ECE Professorship selection committee

Public Service

1. Spring 2022 Judge for Robo Challenge Xtreme (RCX) Student Robotics Competition

2. Spring 2022 Mentoring session for high school FIRST robotics team

Advising

Main Advisor (Graduate)

Ph.D.	Benton Clark	Current (Co-advised w. Dr. Fazleena Badurdeen)
Ph.D.	Pouya Samanipour	Current
MS	David Yackzan	2023
MS	Jonathan Fugal	2020 (Co-advised w. Dr. Jihye Bae)

Graduate Committee Membership

Ph.D.	Amirsaeid Safari	Current
Ph.D.	Jonathan T. Williams	Current
Ph.D.	Pedram Rabiee	Current
Ph.D.	Sumit S. Kamat	Current
Ph.D.	Zhongjun Hu	Current
Ph.D.	Landon Clark (UK ECE)	Current
Ph.D.	Thom Badings (external)	Current
Ph.D.	Joseph Kershaw (UK ECE)	2023
Ph.D.	Peter Kolapo (UK Mining)	2023
MS	Weilian Song (UK CS)	2019

Main Advisor (Other)

UG.	Jordan Mulcahy	2023
HS.	Varun Hariprasad	2023
UG.	Ethan Huff	2021
UG.	Harrison Stranc	2021
UG.	Peter Briggs	2021
UG	Megan Reinhart	2020

Awards

1. 2022 AAAI Conference on Artificial Intelligence Distinguished Paper Award