

Adam Heins

Robotics, optimization, machine learning

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SKILLS

Robotics: model predictive control, motion planning, object manipulation, state estimation, kinematics, dynamics

Optimization: convex programming, sequential quadratic programming, unconstrained optimization

Machine Learning: Gaussian processes, neural networks, reinforcement learning

Tools: ROS, PyTorch, JAX, Linux, git

Languages: C, C++, Python, bash/zsh

EDUCATION

Ph.D. in Aerospace Science and Engineering (Robotics) 2018 – present

Institute for Aerospace Studies, University of Toronto, Canada

Advisor: Prof. Angela P. Schoellig

Thesis: Robust Mobile Manipulation for Robotic Pushing and Nonprehensile Object Transportation

B.A.Sc. in Mechatronics Engineering 2012 – 2017

University of Waterloo, Canada

EXPERIENCE

University of Toronto, Toronto, Canada 2017 – present

Graduate Researcher

- Online and offline planning for fast nonprehensile object transportation with a mobile manipulator [1, 3].
- Robust quasistatic robotic planar pushing with single-point contact using force feedback [2].
- Optimization-based differential inverse kinematics control for mobile manipulation tasks [4].
- Safe online learning for robust robot control with Gaussian processes [5].
- Autonomous inspection of indoor construction sites for progress monitoring using a quadrotor [6].

University of Toronto, Toronto, Canada 2019 – 2022

Teaching Assistant

- Substitute lecturer and head lab TA for undergraduate and graduate courses on robotics (3 courses, 7 terms).

Nest, Palo Alto, USA Summer 2016

Embedded Software Developer Intern

- Implemented in-store demo application for Nest Secure alarm system using C++.
- Wrote Python scripts to analyze and correlate log data stored on the device and in BigQuery.
- Rewrote timer implementation of Nest Secure on top of Linux timer API.

Pebble, Palo Alto, USA Spring, Fall 2015

Embedded Firmware Developer Intern

- Developed the dialog window system for the Pebble Time smartwatch in C.
- Optimized firmware code to increase frame rate by up to 20% and reduce critical path stack usage by 10% on the Pebble.
- Built default watch faces for Pebble Time Round and Golf and Sports apps for Pebble Time.
- Implemented screenshot and power calibration tools for automated testing in Python.

BlackBerry, Mississauga, Canada Summer 2014

Software Developer Intern

- Built BBM simulator in Java to automate tests and reduce testing time by a factor of five.
- Created a REST API with a Cassandra backend to validate user and message statistics.
- Wrote a tool in Java to automatically configure files deployed from Jenkins.

SELECTED PUBLICATIONS

- [1] **A. Heins** and A. P. Schoellig, “Robust Nonprehensile Object Transportation with Uncertain Inertial Parameters,” *IEEE Robotics and Automation Letters*, under review, 2025. [[pdf](#)] [[video](#)] [[code](#)]
- [2] **A. Heins** and A. P. Schoellig, “Force Push: Robust Single-Point Pushing with Force Feedback,” *IEEE Robotics and Automation Letters*, vol. 9, iss. 8, pp. 6856–6863, 2024. [[pdf](#)] [[video](#)] [[code](#)]
- [3] **A. Heins** and A. P. Schoellig, “Keep it Upright: Model Predictive Control for Nonprehensile Object Transportation with Obstacle Avoidance on a Mobile Manipulator,” *IEEE Robotics and Automation Letters*, vol. 8, iss. 12, pp. 7986–7993, 2023. [[pdf](#)] [[video](#)] [[code](#)]
- [4] **A. Heins**, M. Jakob, and A. P. Schoellig, “Mobile manipulation in unknown environments with differential inverse kinematics control,” in *Proc. of the Conference on Robots and Vision*, 2021, pp. 64–71. [[pdf](#)] [[video](#)] [[code](#)]
- [5] M. K. Helwa, **A. Heins**, and A. P. Schoellig, “Provably robust learning-based approach for high-accuracy tracking control of Lagrangian systems,” *IEEE Robotics and Automation Letters*, vol. 4, iss. 2, pp. 1587–1594, 2019. [[pdf](#)]
- [6] M. Nahangi, **A. Heins**, B. McCabe, and A. P. Schoellig, “Automated localization of UAVs in GPS-denied indoor construction environments using fiducial markers,” in *Proc. of the International Symposium on Automation and Robotics in Construction*, 2018, pp. 88–94. [[pdf](#)]

OTHER PROJECTS

- Shadows** [[code](#)] [[demo](#)] 2024 – 2025
Custom game with computer agents trained using reinforcement learning.
- Robotics Outreach** [[info](#)] 2022 – 2023
Organized and led two robotics workshops for Grade 6–11 students using Edison robots.
- Read My Lips** [[code](#)] 2017
LSTM-based neural network to read lips from video frames using Keras, achieving 86% accuracy.