

Adam Heins

Curriculum Vitae

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<https://adamheins.com>

Toronto, ON, Canada

RESEARCH INTERESTS

I am interested in the mechanics of robot motion and manipulation, numerical optimization for robotics, optimal control, imitation and reinforcement learning, and the impact of robotics on society and the natural world.

EDUCATION

Doctor of Philosophy, Robotics

2018 – 2025

Institute for Aerospace Studies, University of Toronto, Canada

Advisor: Prof. Angela P. Schoellig

Thesis: Robust Mobile Manipulation for Robotic Pushing and Nonprehensile Object Transportation [[pdf](#)]

Bachelor of Applied Science, Mechatronics Engineering

2012 – 2017

University of Waterloo, Canada

RESEARCH EXPERIENCE

Acceleration Consortium, University of Toronto, Toronto, Canada

2025 – present

Postdoctoral Research Fellow

Advisors: Prof. Alán Aspuru-Guzik, Prof. Florian Shkurti

- Robotic manipulation for chemistry lab automation using vision-language-action models and reinforcement learning.

University of Toronto, Toronto, Canada

2017 – 2025

Doctoral Researcher

Advisor: Prof. Angela P. Schoellig

- Fast and robust model predictive control for nonprehensile object transportation with a mobile manipulator [[J3](#)].
- Semidefinite programming for *physically realizable* inertial parameters [[J1](#)].
- Robust quasistatic robotic planar pushing using *only* force feedback to sense the pushed object [[J2](#)].
- Safe online learning for robust manipulator control with Gaussian processes [[J4](#)].
- Differential inverse kinematics control for mobile manipulation in unknown environments [[C1](#)].
- Autonomous inspection of indoor construction sites using a quadrotor [[C3](#), [C4](#)].

TEACHING EXPERIENCE

University of Toronto, Toronto, Canada

2019 – 2022

Teaching Assistant

- ROB 301: Introduction to Robotics, instructed by Prof. G. M. T. D’Eleuterio (4 terms)
 - Head lab TA supervising students implementing classic robotics algorithms on Turtlebots.
- ROB 310: Mathematics for Robotics, instructed by Prof. A. P. Schoellig (1 term)
 - Substitute lecturer for 6 hours of content including optimization and singular value decomposition.
- AER 1514: Mobile Robotics, instructed by Prof. T. D. Barfoot (2 terms)
 - Marking and assistance with student autonomous vehicle projects.

MENTORSHIP

During my doctoral studies I mentored two undergraduate students (Kohava Mendelsohn, Michelangelo Fantini) and two junior Ph.D. students (Xintong Du, Federico Pizarro Bejarano). As a postdoctoral fellow I am currently mentoring one undergraduate student (Kevin Deng) and one junior Ph.D. student (Hrish Leen).

PUBLICATIONS

Journal Articles

- [J1] **A. Heins** and A. P. Schoellig, “Robust nonprehensile object transportation with uncertain inertial parameters,” *IEEE Robotics and Automation Letters*, vol. 10, iss. 5, pp. 4492–4499, 2025. [[pdf](#)] [[video](#)] [[code](#)]
- [J2] **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](#)]
- [J3] **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](#)]
- [J4] 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](#)]

Peer-Reviewed Conference Proceedings

- [C1] **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](#)]
- [C2] N. Kayhani, A. Abelaal, B. McCabe, **A. Heins**, and A. P. Schoellig, “Tag-based indoor localization of UAVs in congested construction environments: opportunities and challenges in practice,” in *Proc. of the Construction Research Congress*, 2020, pp. 226–235. [[pdf](#)]
- [C3] N. Kayhani, **A. Heins**, W. Zhao, M. Nahangi, B. McCabe, and A. P. Schoellig, “An improved tag-based indoor localization of UAVs using an extended Kalman filter,” in *Proc. of the International Symposium on Automation and Robotics in Construction*, 2019, pp. 624–631. [[pdf](#)]
- [C4] 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](#)]

Extended Abstracts

- [A1] **A. Heins** and A. P. Schoellig, “Fast nonprehensile object transportation on a mobile manipulator,” *Mobile Manipulation and Embodied Intelligence Workshop, IEEE International Conference on Robotics and Automation*, 2024. [[pdf](#)]
- [A2] **A. Heins** and A. P. Schoellig, “Robust single-point pushing with force feedback,” *Embracing Contacts Workshop, IEEE International Conference on Robotics and Automation*, 2023. [[pdf](#)]

SERVICE AND EVENTS

Reviewer	2019 – 2026
ICRA, IROS, L4DC, LCSS, RAL, RSS, TRO, TCST, WAFR.	
Organizer, ICRA Workshop [info]	2026
Accelerating Discovery in Natural Science Laboratories with AI and Robotics	
Organizer, CRC Symposium Roundtable [info]	2025
The North Builds: Shaping a National Identity in Robotics and AI.	
Robotics Outreach [info]	2022 – 2023
Organized and led a series of robotics workshops for Grade 6–11 students using Edison robots.	

WORK EXPERIENCE

Google Nest, Palo Alto, USA

Summer 2016

Embedded Software Developer Intern

- Implemented in-store point-of-sale app, rebuilt internal timer API, and developed log data analysis tools for the Nest Secure alarm system.

Pebble, Palo Alto, USA

Spring, Fall 2015

Embedded Firmware Developer Intern

- Developed firmware and applications for the Pebble Time smartwatch including the dialog window system, default watch faces, and sports apps, as well as screenshot and power calibration tools.

BlackBerry, Mississauga, Canada

Summer 2014

Software Developer Intern

- Implemented tools for user and message simulation and validation, automated testing, and configuration deployment for BlackBerry Messenger (BBM).

ADDITIONAL PROJECTS

Technical blog [[link](#)]

An informal way to write about and share technical topics that interest me.

pyb_utils [[code](#)]

Utilities for PyBullet, including collision detection, visual-only objects, cameras, and named tuples.

xacrodoc [[code](#)]

Compile xacro files to URDF or MJCF from Python or the command line, without ROS.

TECHNICAL SKILLS

Robotics: optimal control, trajectory optimization, (mobile) manipulation, force control, computer vision, state estimation, dynamics, kinematics

Machine Learning: foundation models, reinforcement learning, Gaussian processes

Optimization: convex programming, nonlinear programming, unconstrained optimization

Programming: Python, C/C++, shell

PERSONAL INFORMATION

Status: Canadian citizen

Languages: English

Hobbies and Interests: hiking, camping, drawing, baking

REFERENCES

Angela P. Schoellig, *Alexander von Humboldt Professor*, Technische Universität München
Ph.D. supervisor, e-mail: angela.schoellig@tum.de

Timothy D. Barfoot, *Professor*, University of Toronto
Ph.D. committee member, e-mail: tim.barfoot@utoronto.ca

Steven L. Waslander, *Professor*, University of Toronto
Ph.D. committee member, e-mail: steven.waslander@utoronto.ca