

# Taylor A. Howell

OPTIMIZATION · CONTROL · ROBOTICS

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## Summary

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Currently, I'm a Ph.D. candidate at Stanford University. I work on optimization-based tools for motion planning of complex, underactuated robotic systems. My expertise includes: numerical optimization, technical computing, automatic control, and modeling of dynamical systems.

## Education

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### Stanford University

PH.D. IN MECHANICAL ENGINEERING

- Automatic Controls, Robotics
- Advisors: Zachary Manchester, Allison Okamura

Stanford, CA, USA

Sept. 2017 - June. 2022 (expected)

### Stanford University

M.S. IN MECHANICAL ENGINEERING

- Automatic Controls, Robotics

Stanford, CA, USA

Sept. 2017 - June. 2019

### University of Utah

B.S. IN MECHANICAL ENGINEERING

- Summa Cum Laude
- Capstone Project: Wireless Power for Aerial Robots

Salt Lake City, UT, USA

May 2013 - Dec. 2016

## Research

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### Robotic Exploration Lab, Stanford University

RESEARCH ASSISTANT

My research is focused on developing optimization-based tools for motion planning of underactuated robotic systems. Currently, I'm working on algorithms for robust feedback motion planning and solvers for contact-implicit trajectory optimization. Previously, I was co-leading development of `TrajectoryOptimization.jl`, an open-source Julia package for solving constrained trajectory optimization problems.

Stanford, CA, USA

May 2018 - present

### Telerobotics Laboratory, University of Utah

RESEARCH ASSISTANT

I devised and implemented a control scheme to sort swarms of microrobots using rotating uniform magnetic fields for minimally invasive medical applications. This work included: applied physics, simulation, nonlinear optimization, fabrication of a scaled microrobot swarm, and writing C++ code to control a tri-axial Helmholtz-coil system.

Salt Lake City, UT, USA

Oct. 2015 - Dec. 2016

### Utah Center of Excellence for Biomedical Microfluidics, University of Utah

RESEARCH ASSISTANT

I designed and built a forty-eight-syringe pump for a medical microfluidic system, developed standard operating procedures for a high-throughput drug screening and cytotoxicity evaluation system, and performed statistical analysis for ovarian-cancer cell experiments.

Salt Lake City, UT, USA

Sept. 2014 - Oct. 2015

## Publications

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- 2021 **Direct Policy Optimization using Deterministic Sampling and Collocation**, T. Howell, C. Fu, Z. Manchester. <https://arxiv.org/abs/2010.08506>. Submitted to RAL-ICRA.
- 2020 **Scalable Cooperative Transport of Cable-Suspended Loads with UAVs using Distributed Trajectory Optimization**, B. Jackson\*, T. Howell\*, K. Shah, M. Schwager, Z. Manchester. Robotics and Automation Letters.
- 2019 **ALTRO: A Fast Solver for Constrained Trajectory Optimization**, T. Howell\*, B. Jackson\*, Z. Manchester. International Conference on Intelligent Robots and Systems. Macao, China.
- 2018 **Sorting Rotating Micromachines By Variations in Their Magnetic Properties.**, T. Howell, B. Osting, J. Abbott. Physical Review Applied.
- 2017 **Use of a highly parallel Microfluidic Flow Cell Array to determine therapeutic drug dose response curves.**, J. Arellano, T. Howell, J. Gammon, S. Cho, M. Janat Amsbury, B. Gale. Biomedical Microdevices.

## Skills

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**Programming** Julia, C++, Python, Matlab, R  
**Computational**  $\LaTeX$ , Git, Linux, SNOPT, Ipopt, Convex.jl, MeshCat, Solidworks, ROS, Adobe Premiere Pro, Adobe Illustrator, Arduino  
**Fabrication** Mill, Lathe, Vacuum Forming, Laser Cutting, Mold Making and Casting, Metal Sheet Fabrication

## Experience

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### **GREAT Summer Camp, Department of Computer Science, University of Utah**

*Salt Lake City, UT, USA*

INSTRUCTOR

*Jun. 2017 - Jul. 2017*

- led a teaching team of three
- taught practical robotics and programming skills to elementary school students using the LEGO Mindstorm platform
- developed projects and challenges for FLL skills, telerobotics, and kinetic-art themed weeks

### **Cornaby-Howell LLC**

*Salt Lake City, UT, USA*

CO-FOUNDER, ENGINEER

*Apr. 2015 - Oct. 2015*

- prototyped systems: touch-display module with GUI, Arduino C code, a lead-screw system, and syringe attachment modules for precision high-throughput syringe pumps
- designed hardware schematics for patent application

### **Ramada Limited Draper**

*Draper, UT, USA*

FRONT DESK CLERK

*Apr. 2013 - Aug. 2013*

- manager on duty: checked in and out guests, made reservations, and ran breakfast
- developed communication and practical problem solving skills

### **Designer**

*Draper, UT, USA*

TWISTY PUZZLES

*Aug. 2007 - Jan. 2011*

- designed and built twisty puzzles with selling prices ranging from \$25 - \$850
- exhibited my work at the community's premier international event: Dutch Cube Day 2008

## Community Outreach

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- 2019 **Co-organizer**, of Social Impact Night event at Stanford University to connect social-impact focused students and entrepreneurs
- 2016 **Mentor**, to three summer interns at the Telerobotics Laboratory and developed soft robots with potential as catheter tips that will increase insertion distance deep in the brain and other hard-to-reach locations in the body
- 2015 **Science-fair Judge**, for local elementary school to provide feedback to students about their projects

## Fellowships & Scholarships

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Stanford Graduate Fellowship (2017 – 2018) · University of Utah Undergraduate Research Opportunities Program Fellowship (2016) · The Boeing Company Scholarship (2016) · Shirley L. & Kathelyne O. Evans Endowed Scholarship (2016) · Big Ten+ Grad Expo Travel Scholarship (2016) · University of Utah Presidential Scholarship (2013 – 2016)

## Coursework

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Convex Optimization · Optimal Control · Nonlinear Control · Advanced Software Development · Engineering Design Optimization · Deep Learning · State Estimation · Principles of Robotic Autonomy · Introduction to Mechatronics · Linear Dynamical Systems · Introduction to Robotics · Machine Learning · Decision Making Under Uncertainty · Control Design Techniques · Advanced Robotic Manipulation · Advanced Feedback Control · Introduction to Optimization · Experimental Robotics · Multi-robot Systems · State Space Control · Design of Experiments · Introduction to Finite Element Method · Programming for Engineers