Travis Hainsworth

Curriculum Vitae

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Education

2022–Present	**Assistant Professor of Teaching**, *University of Colorado*, Boulder. Teaching Intro to Robotics, System Dynamics, Machine Learning, and Artificial Intelligence.
2017–2023	**Doctor of Philosophy**, *University of Colorado*, Boulder, *3.85 GPA*. Mechanical Engineering with an emphasis in 3D printed robotic systems.
2016–2017	**Master of Science**, *University of Utah*, Salt Lake City, *3.6 GPA*. Mechanical Engineering with an emphasis in Robotics.
2012–2016	**Bachelor of Science**, *University of Utah*, Salt Lake City, *3.5 GPA*. Mechanical Engineering with an emphasis in Robotics.

Publications

- **T. Hainsworth**, V. Venkata, M. Mcgraw, C. Keplinger, G. Whiting, R. MacCurdy, *Bio-Inspired Untethered Locomotion of Soft Snake Robot*, In Preparation Science Robotics.

- **T. Hainsworth**, I. Schmidt, V. Sundaram, C. Keplinger, R. MacCurdy, *Simulating Electrohydraulic Soft Actuator Assemblies Via Reduced Order Modeling*, IEEE Robosoft 2022.

- B. Hayes, **T. Hainsworth**, R. MacCurdy, *Inkjet Liquid-Solid Co-Printing of Multi-Material 3D Fluidic Devices*, Under Review Science Advances 2022.

- L. Smith, **T. Hainsworth**, J. Haimes, R. MacCurdy, *Automated Synthesis of Pneumatic Soft Actuators*, IEEE Robosoft 2022.

- L. Smith, **T. Hainsworth**, Z. Jordan, X. Bell, R. MacCurdy, *A Seamless Workflow for Design and Fabrication of Multimaterial Pneumatic Soft Actuators*, Automation Science and Engineering (CASE) 2021, **Best Application Paper Award**.

- **T. Hainsworth***, L. Smith*, S. Alexander and R. MacCurdy, *A Fabrication Free, 3d Printed, Multi-Material, Self-Sensing Soft Actuator*, RAL, 2020, **co-first authors*.

Relevant Coursework

Automated Mechanical Design Synthesis	Robotic Controls
Machine Learning	Artificial Intelligence
Motion Planning	Classical Controls
Introduction to Robotics	Programming for Engineers
System Identification for Robotics	Mechatronics I
3D Computer Vision	Mechatronics II

Selected Achievements

2021	IEEE CASE Best Application Paper award - 2nd author
2019	Founder and President of the CU 3D Printing Club at CU Boulder
2018	Certified Engineering Graduate Student Mentor
2018	Nominated and awarded an outstanding TA Fellowship

| 2015 | 1 of 5 students accepted in the University of Utah's BS/MS program |
| 2014 | 2nd place in ASME's local Undergraduate Research competition |

Skills

Programming

C++	20,000+ Lines	*Including hardware control*
Matlab	10,000+ Lines	
Python	5,000+ Lines	
LaTeX	5,000+ Lines	*Including Tensorflow and Keras*
Julia	1,000+ Lines	
CUDA	1,000+ Lines	*Including GVDB*

Manufacturing
Mill
CNC Mill
Lathe
Fused Deposition Modeling
3D Poly-jet Printing

Modeling
Solidworks
Fusion 360
Feature CAM
Open SCAD
PCB Design

Simulating
Virtual Robotics Experimentation Platform (VREP)
Custom Mass Spring Damper

Experience

Vocational

May 2018 – Present. **Research Assistant**, *University of Colorado*, Boulder.
Researcher in Dr. Robert MacCurdy's lab where we study 3D printable robotic systems and the technologies to create such robots.
- Aided in outfitting Dr. MacCurdy's startup lab.
- Mentored four undergraduate researchers.

Jan 2018 – May 2018. **Teacher's Assistant**, *University of Colorado*, Boulder.
Assisted for the graduate level mechanical engineering course "Automated Mechanical Design Synthesis".
- Nominated and awarded Outstanding TA fellowship.
- Created homework sets and solutions.

Aug 2017 – Dec 2017. **Teacher's Assistant**, *University of Colorado*, Boulder.
Assisted with the undergraduate level mechanical engineering course "Statics".
- Created and taught multiple lectures.
- Created homework sets and solutions.

Aug 2012 – Jul 2017. **Route Setting Manager**, *Momentum Climbing*, Salt Lake City.
Head route setter for Utah's largest climbing gym's flagship location.
- Managed all setter's schedules and weekly responsibilities to fulfill the gym's needs.
- Created rock climbing routes of all difficulties that suited all ages and sizes.
- Cataloged all routes and set each route's life span.

May 2015 – May 2016. **First Lego League Head Coach**, *REFUGES*, Salt Lake City.
Facilitated a First Lego League team for the non-profit, after school program REFUGES (Refugees Exploring the Foundations of Undergraduate Education in Science).
- Head Lego League coach for seven children from refugee families.
- Taught the team how to utilize Lego Mindstorm robots; both assembly and programming.

Jan 2014 – May 2015. **Mechanical Engineering Intern**, *Kairos Autonomi*, Salt Lake City.
Assisted the R&D department with the DARPA Robotics Challenge.
- Developed a hexapod with a team of three engineers for competing in the DARPA Robotics Challenge.
- Created a dynamic model of the robot utilizing VREP.

May 2014 – **Camp Coach**, *GREAT Summer Camps*, Salt Lake City.
Aug 2014. GREAT (Graphics and Robotic Exploration with Amazing Technologies) introduces youth to modern technologies that are likely inaccessible through their primary and secondary education.
- Introduced elementary school children to the Lego Mindstorm toolkit.
- Introduced elementary school children to the fundamental ideas behind mechanical engineering and programming.

Jan 2013 – **Research Assistant**, *Computational Solid Mechanics Research Group*, Salt Lake City.
Aug 2013. Evaluated various software for simulating underground explosions for more effective mining.
- Learned how to operate SIMP and UINTA finite element packages and wrote a compare and contrast paper to facilitate an intelligent software choice for the team.

Selected Projects

Jan 2021 – **Untethered Soft Robot**, *Publication in Work*, Completely Untethered Entirely Soft High Voltage Robot.
Present.
- Designed and assembled custom circuitry for driving high voltage soft actuators.
- Lead designer of robot morphology inspired by snake anatomy.
- Developed a Matlab app for analyzing the effect of actuator design on performance.

June 2020 – **BVM Compression Device**, *Internal Lab Project*, Autonomous COVID Bag Valve Mask Compression
April 2020. Compression.
- Developed a device to repetitively compress a bag valve mask for the COVID pandemic as ventilators became unobtainable.
- Collaboration with UC Health Memorial Hospital in Colorado Springs.
- Team lead of an entirely virtual project collaboration.

Aug 2019 – **3D Printed Pneumatic Actuator with Sensor Integration**, *Published Work*, Multi-Material, Human Free
April 2020. Manufacturing.
- Co-first author of RAL published work featuring a 3D printed pneumatic actuator.
- The actuator incorporates a resistive strain gauge which is 3D printed in tandem with the actuator, requiring no human involvement in manufacturing process.
- Responsible for the process development of the manufacturing of the actuator.

Feb 2018 – **M4CP**, *Internal Lab Project*, Four Channel Multi-Material 3D Printer.
Present.
- Independent project designing and manufacturing a custom 3D printer.
- Capable of printing up to four materials (liquids and/or solids) simultaneously.
- Each nozzle features independent height control.

Jan 2016 – **PETE**, *Masters Thesis*, Quadrupedal Emotive Gait Generation.
Jul 2017.
- Developed a 28 DOF quadruped that displays emotions through walking gaits
- By parameterizing step length, height, body angle, and other such features it is possible to create gaits that humans will interpret as emotional
- Obtained closed form solution to the inverse kinematics of the 7 DOF legs by inverting the Rodrigues Rotation Formula in order to relate the elbow's position to the body
- Self proposed and self funded thesis under the advisory of Mark A. Minor, Ph.D.

May 2014 – **Shadow Bot**, *Senior Design Project*, Autonomous Clean Room Lab Mate.
May 2015.
- Team leader for this senior design team of eight.
- Designed, fabricated, and assembled a robot to follow lone lab occupants autonomously.
- Robot facilitated hands free remote video conferencing while moving through the lab's clean room.

Jan 2014 – **FIDO**, *Independent Study*, Quasi-Static Gait Generation.
May 2014.
- Developed a 20 DOF quadruped with various quasi-static gaits.
- Programmed in Matlab and ported to C++.
- Obtained closed form solution to the inverse kinematics.