Hayden M. Webb

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Education

Cornell University — **Ithaca, NY**
Doctor of Philosophy in Robotics (Mechanical) — ***Expected Graduation: May 2030***

William Marsh Rice University — **Houston, TX**
Bachelor of Science in Mechanical Engineering — ***Graduation: May 2025***
Minor in Engineering Design — Distinction in Research and Creative Works
Specialization in Mechanics and Dynamics

Research Interests

- Robotics
- Biomechanics
- Mechatronics
- Engineering Design
- Manipulation
- Augmentation

Publications

2025

H. Webb, S, Yuan, and K. Hang; Robust In-Hand Manipulation for Parallel Jaw Grippers through Remote Center of Compliance and Active Surfaces
[In Preparation for submission to IEEE Robotics and Automation Process (RA-P)]

- Designing a robot hand for parallel jaw grippers to provide full spatial manipulation through the use of active surfaces, compliant fin-rays, and a remote center of compliance (RCC) beam system
- Developing a self-identification manipulation algorithm utilizing force primitives to parameterize and test the hand's manipulation capabilities for objects of variable geometry

2024

H. Webb, P. Changrunmaneekul., S, Yuan, and K. Hang;Wearable Roller Rings to Augment In-Hand Manipulation through Active Surfaces*, arXiv preprint 2403.13132*
[Under consideration for IEEE International Conference on Intelligent Robots and Systems (IROS) 2025]

- Designed in-hand manipulator for both human & robotic grasping systems for differential, non-holonomic, and full spatial manipulation
- Developed a generalized active surface-based motion model for arbitrary geometry objects

Patents

2024

H. Webb,, S, Yuan, and K. Hang; "Wearable Roller Rings to Augment In-Hand Manipulation through Actives Surfaces" - US Provisional Patent: Date of Application (July 3, 2024)

Presentations

2025

K. Noonan, B. Ramsey, J. Villarreal, **H. Webb**; Automated Screen Printer for Fabrication of Electrodes for Biosensors. Rice University Huff Engineering Design Showcase [Poster]

2024

H. Webb, P. Changrunmaneekul., S, Yuan, and K. Hang; Wearable Roller Rings to Enable Robot Dexterous In-Hand Manipulation through Active Surfaces. ASME Mechanism and Robotics Committee [Talk/Poster]

H. Webb, P. Changrunmaneekul., S, Yuan, and K. Hang; Wearable Roller Rings to Enable Robot Dexterous In-Hand Manipulation through Active Surfaces. Texas Regional Robotics Symposium (TEROS) [Poster]

2022

J. Chang, R. Lee, **H. Webb**; Body Cooling Device for the Cooling of Humans in Heat Waves. Rice University Engineering Design Showcase [Poster]

Awards

Distinction in Research and Creative Works ***May 2025***
William Marsh Rice University

Undergraduate Teaching Fellow, Mechanical Engineering ***Jan. 2025***
William Marsh Rice University

3rd Place, Student Mechanism and Robot Design Competition (SMRDC) ***Aug. 2024***
American Society of Mechanical Engineers (ASME)

ASME Student Financial Support Award ***Jun. 2024***
American Society of Mechanical Engineers (ASME)

Undergraduate Teaching Fellow, Mechanical Engineering ***Jan. 2024***
William Marsh Rice University

Technical Skills

CAD Software: SolidWorks, Onshape, Fusion360
Programming Languages: Python, ROS, C++, Matlab
Hardware: 3D Printing, Product Design and Manufacturing, Microcontroller (Arduino), Subtractive Manufacturing
Tools: Microsoft Office (Word, Excel, Powerpoint), LaTeX

Selected Projects

Automated Screen Printer for Fabrication of Electrodes for Biosensors ***Aug. 2024 - May 2025***
Senior Capstone Design Project

- Fully developed an automated screen printer for electrode fabrication in the Sempionatto Research Group capable of taking in an electrode vector file and outputting fully screened sensors with a 95% yield
- Independently designed and constructed a working gantry for movement in all cartesian directions
    - Device's machined parts were fabricated through the use of various subtractive manufacturing methods such as plasma-cutting, waterjet-cutting, and laser-cutting
- Designed a primitive weighted motion planner for ink and screening toolpaths, generating task-space coordinates with motor control flags in G-code format for electronics bus
- Created closed-loop velocity and position control for use in gcode execution and device homing/jogging
- Developed a custom UI for preprocessing electrode vector files, modeled after common 3D printing slicers to streamline tool path generation, repeated electrode Cricut file, and parameter tuning

Electronic Prony Brake Torquemeter ***Jun. 2024 - Aug. 2024***

Rice Mechanical Engineering Department

- Designed and developed multiple functional 3D-Printed Prony Brakes to mechanically test the concepts of dynamic torque, speed, and power through inset motors and load cells.
- Built an electronic subsystem consisting of a photo interrupter, Arduino microcontroller, and signal amplifier to calculate the power output of a motor for use in an upper level mechanical engineering course.

Body Cooling Device for the Cooling of Humans in Heat Waves ***Jan. 2022 - May 2022***

Engineering Design Coursework

- Developed a convective body cooling suit for individuals to wear during 95+% humidity to cool down.
- Designed a water-driven cooling subsystem with water-blocks located at high-temperature regions in the body to dissipate heat more effectively from the body.
- Optimized design using calculations of heat dissipation for intended use case in nominal human subjects.

Grasping Aid Device for Arthrogryposis Multiplex Congenita (AMC) ***Aug. 2021 - Dec. 2021***

Engineering Design Coursework

- Manufactured an underactuated robotic glove for performing power and precision grasps in daily activities for a client with underdeveloped flexor tendons
- Designed and assembled cable-driven mechanism for furling and unfurling of fingers

Technical Experience

Lead Engineer, Team Pressing Matters ***Aug. 2024 - May 2025***

Senior Capstone Design Project

- Oversaw team deadlines and communication with sponsors and collaborators, ensuring proper communication on work between the client and development team throughout the project
- Performed several technical design reviews on mechanical subsections to ensure feasibility and design optimization in terms of modularity, cost, and ease of construction

Co-President ***May 2023 - May 2024***

Rice Robotics Club

- Managed and aided 10+ subteams and 50+ students on the development of various robotics projects such as several featherweight combat robots and a biomimetic four-legged walking robot
- Developed new safety and testing procedures for R&D and Combat Robotics subteams
- Organized and instructed several workshops, talks, and presentations on robotics and engineering skills

Team Lead, Mirrored Robot Arm Subteam ***May 2022 - May 2023***

Rice Robotics Club

- Led the development and construction of 6-DoF underactuated robot arm and 17 DoF robot hand
- Promoted collaboration on the integration of manufactured components with electronics subteams to allow for primitive mirroring of human movement in a small-form device

Team Lead, Highschool Aerospace Scholar ***Oct. 2019 - Jul. 2020***

National Aeronautics and Space Administration (NASA)

- Led 20+ students on the design of a theoretical human landing system between Gateway Space Station and the lunar surface utilizing integrated CAD environment
- Collaborated with other teams to integrate Lunar Lander into theoretically designed Gateway Space Station for mock Artemis Mission

Teaching Experience

Head Teaching Assistant (ENGI 210 - Prototyping & Fabrication) ***Jan. 2023 - May 2025***

Rice Makerspace, Oshman Engineering Design Kitchen (OEDK)

- Taught material, hosted tutorials, and led workshops on engineering tools and fabrication methods
- Assisted 50+ graduate and undergraduate students with team projects and individual competencies in engineering design

Teaching Assistant (MECH 310 - Rigid Body Dynamics) ***Jan. 2025 - May 2025***

Rice Undergraduate Teaching Fellow Program, Mechanical Engineering Department

- Assisted with teaching and grading of material for 50+ undergraduate students

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Rice Undergraduate Teaching Fellow Program, Mechanical Engineering Department

- Assisted with teaching and grading of material for 50+ undergraduate students

IBB Summer Academy Assistant ***Jun. 2022***

Rice Department of Innovation

- Led 3 week-long courses for high school students on engineering design tools, devices, and processes

Relevant Coursework

Algorithmic Robotics, Engineering Design Studio, Engineering Design Tools, Fundamentals of Robotic Manipulation, Fundamentals of Control Systems, Introduction to Operations Research and Optimization, Heat Transfer, Machines and Mechanisms, Modeling Dynamic Systems, Prototyping & Fabrication, Rigid Body Dynamics, Thermodynamics