Joshua M. Campbell

Oregon State University, Robotics Engineering M.S. student

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Education

Expected Graduation: August 2022

M.S. in Robotics Engineering
Oregon State University (OSU)

- Research: robot hand benchmarking, manipulation task decomposition, and using benchmarks to design robot hands.

June 2020

B.S. Mechanical Engineering
Oregon State University (OSU)

Research Experience

Using Benchmarks for Designing Robot Hands *(Spring 2022 - Current)*
Advisors: Cindy Grimm and Ravi Balasubramanian

- Automatically design robot hands that are optimal for a given benchmark or component(s) of the benchmark. The initial benchmark used is the Asterisk Test [4], in which the hands will be compared to understand what about one design makes it better for a specific type of manipulation over another hand's design.
- Using and developing on the lab's simulator environment Mojograsp and developed an automatic hand generator using blenders API to create the hand models for the simulator.

Printing on Curved Surfaces with a Mobile 3D Printer *(Spring 2022 - Current)*
Advisors: Cindy Grimm and Matt Campbell

- Develop a 3D printer that is able to be placed next to an object and 3D print on the objects surface, including curved surfaces.
- Primary focus is on the physical system ensuring the mechanical, electrical and software components function together.

Dividing Complex Manipulation Tasks into Sub-Tasks *(Winter 2021 - Winter 2022)*
Advisors: Cindy Grimm and Ravi Balasubramanian

- Creating the framework for breaking a manipulation task into a decision tree comprised of sub-tasks which can be related to in-hand manipulation benchmarks [1].

Developing Test Equipment for Robotic Manipulators *(Summer 2020 - Current)*
Advisors: Cindy Grimm and Ravi Balasubramanian

- Designing and building test equipment that allows for automating the testing process of robot manipulators.
- Test equipment includes a reset bed which an object can be picked up and moved by a manipulator and then resets the object to the home position and desired orientation. A door and drawer analog that can be pulled open by the manipulator and automatically closed door/drawer afterwards.

Benchmarking Robot Hand Designs *(Fall 2019 - Current)*
Advisors: Cindy Grimm, Ravi Balasubramanian, and John Morrow

- Developing metrics that allow for quantifying the ability of a robot hand design to perform in-hand manipulations, Asterisk Test [2, 4].

- Develop metrics to describe the reachable region of a robot hand for precision or power grasps [3]
- Designed puppeted versions of current robot hands, along with several new hands to be used in the studies.

Mentoring, Management and Teaching Experience

Mentor for First Robotics Team *(January 2022 - Current)*

- Engineer mentor for a local FIRST Robotics team, Scalawags 1359. Primarily focused on designing with CAD software, and teaching the engineering thought process for designing mechanical systems.

Mentoring and Management of Undergraduates

- Mentor for the REU program, two undergraduate students the first year and an additional REU student and two high school students this summer.
- Mentoring a senior capstone team of four undergraduate seniors. Project is developing a calibration process to link an overhead camera, a table work space and a robot arm with out the need to make physical measurements.
- Managing the "Developing Test Equipment for Robot Manipulators" project since summer 2020. Includes managing up to six graduate/undergraduate researchers at once, currently managing four undergraduates.

Lab Manager

- Conducted interviews for potential undergraduate researchers to join our research lab.
- Manage and maintain 3D printer farm (multiple Prusas, Lulzbot, and Ultimaker).
- Coordinated and conducted moving our lab to a new facility and setting up the new space to allow for the best utilization.
- Procurement of lab equipment including robot arm, 3D printer and general hardware.

Graduate Teaching Assistant, ME317: Intermediate Dynamics *(Fall 2020)*

- Class covered kinematics and dynamics.
- Held office hours to answer questions and clarify topics for the undergraduate students.

Work Experience

April - September 2019

PCC Structural, Schlosser Plant – Redmond, OR

Development Engineer Intern

- Assisted in the implementation of the titanium casting process for new parts. Involvement in creation of work instructions, reading of customer blueprints, and modifications to 3D models.
- Improved existing parts through analyzing the parts at different stages to find points where defects occur and implement steps to prevent the defects.
- Created documentation for 3D scanning and analyzing parts, based on my experience of 3D scanning and analyzing the scans for defects.

April - September 2018

Blount International, ICS Division – Portland, OR

Manufacturing Engineer Intern

- Conducted quality control studies to test if the diamond segments will meet the quality requirements when the production rate is increased.
- Redesign of a fixture used to locate and hold the diamond segments and the chain together during the laser welding process.
- Implemented batching software for the diamond segment manufacturing process. The software will decrease waste and increase the consistency between batches while providing useful data on each batch.

Other Relevant Experience

OSU Robotics Club, Rover Team *(Fall 2019 - Spring 2020)*

- Worked on the mechanical team, primarily focused on designing and building hardware for the testing the different systems on the rover.
- Designed mounting solution to allow for testing of the robot arm while separated from the overall rover.

Technical Skills

Equipment: 3D printing, 3D Scanning, Soldering, general machining
Programming: Python, Arduino, MATLAB, Latex
General Software: ROS, Blender, Pybullet, Git, GrabCAD, Linux, Docker, googling
CAD Software: Solidworks, Inventor, Siemens NX

Publications

1. [IN REVIEW], **Campbell, J.**, Morrow, J., Balasubramanian, R. & Grimm, C. *Evaluating a Framework for Dividing a Complex Manipulation Task into Parameterized Object-Centric Sub-Tasks* in *International Conference on Intelligent Robots and Systems (IROS)* (2022).
2. [IN REVIEW] Morrow, J., **Campbell, J.**, Balasubramanian, R. & Grimm, C. Benchmarking planar rotation capabilities of robot hands. *IEEE Robotics and Automation Letters* (2022).
3. Morrow, J., **Campbell, J.**, Nishat, N., Balasubramanian, R. & Grimm, C. *Measuring a Robot Hand's Graspable Region using Power and Precision Grasps* 2022.
4. Morrow, J., **Campbell, J.**, Balasubramanian, R. & Grimm, C. Benchmarking a Robot Hand's Ability to Translate Objects Using Two Fingers. *IEEE Robotics and Automation Letters* **7**, 588–593 (2021).