Jace Aldrich

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Education

PH.D. IN ROBOTICS | MAY 2027
- The University of Michigan
- Cumulative GPA: 4.0/4.0

M.S. IN MECHANICAL ENGINEERING | MAY 2023
- The University of Alabama
- Cumulative GPA: 4.0/4.0

B.S. IN MECHANICAL ENGINEERING | MAY 2022
- The University of Alabama
- Randall Research Scholars Program
- Cumulative GPA: 4.0/4.0

Experience

GRADUATE RESEARCH STUDENT | PROGRESS LABORATORY AT THE UNIVERSITY OF MICHIGAN| AUGUST 2023-PRESENT
- Developed Model Predictive Control (MPC) variants to factorize the algorithm
- Conducted literature review on state-of-the-art planning and control methods for robotics
- Performed multiple outreach events for robotics and general engineering for middle and high school students

GRADUATE R&D INTERN | SOUTHWEST RESEARCH INSTITUTE | MAY 2023– AUGUST 2023
- Developed a robotics simulation package to work with dynamic motion planning and control in space and other zero or low gravity environments
- Developed hardware twin elements to match robotic simulation work
- Designed a ROS2 controller for a robotic arm from its firmware package
- Developed Docker pipelines for automatic workspace configuration and compilation for multi-repository projects

GRADUATE RESEARCH STUDENT | CONTROL OF HUMAN AND ROBOTIC SYSTEMS LABORATORY | AUGUST 2022-MAY 2023
- Designed and assembled a two degree of freedom motion platform to operate in parallel with a rehabilitative exoskeleton and virtual reality environment
- Conducted finite element analyses to ensure participant safety across all possible platform orientations
- Solved forward and inverse kinematics for the platform and defined low-level control laws for the platform
- Designed a ROS (Robot Operating System) action server allowing for low-level, non-linear control of a six degree of freedom collaborative robot arm as well as easily changeable control laws and parameters
- Designed and taught a seminar to faculty, graduate students, and undergraduate students describing ROS's framework, development process, command line interface, and common packages

GRADUATE R&D INTERN | SOUTHWEST RESEARCH INSTITUTE | JUNE 2022– AUGUST 2022

- Designed a demonstration for robotic arms with space applications wherein a robotic arm built a Jenga tower on a turntable, demonstrating robotic capabilities with rotating frames commonly seen in space
- Developed, evaluated, and finalized custom ROS packages for the demo relating to motion planning, transformation frames, and computer vision, resulting in a fully functional demonstration
- Developed and implemented a pipeline for hardware agnostic autonomous vehicle software deployment

UNDERGRADUATE RESEARCHER | CONTROL OF HUMAN AND ROBOTIC SYSTEMS LABORATORY | UNIVERSITY OF ALABAMA | AUGUST 2019 – MAY 2021, AUGUST 2021 – MAY 2022

- Combined Functional Electrical Stimulation (FES) and robotic components towards helping rehabilitate handicapped individuals
- Created control algorithms for sensor data, robotic actuation, and FES stimulation in Simulink
- Created and maintained the mechanical design of a hybrid exoskeleton for the bicep and tricep
- Assembled and tested the hybrid exoskeleton for data collection towards improving rehabilitative use
- Created and conducted experiments to improve the effectiveness of the hybrid exoskeleton and FES
- Developed Novel Robust and Adaptive control methods involving human-robot interaction dynamics
- Disseminated research in multiple outlets, resulting in three publications
- Mentored students in conducting similar research projects.

LEAD LAB MANAGER | RANDALL RESEARCH SCHOLARS PROGRAM | JANUARY 2019 - MAY 2021 AND AUGUST 2021-PRESENT

- Oversaw the day-to-day operations and long-term goals of the Randall Research Scholars Program Computing Lab for approximately 160 students in an open, research-oriented lab environment
- Managed Windows operations such as Imaging, Hyper-V Virtual Machines, Active Directory, file shares, and backups for seven physical servers and over sixty virtual machines and desktop computers
- Created and managed a System Center Configuration Management (SCCM) Environment
- Led administrative tasks and managed co-workers; ran meetings and allocated job roles to eight co-workers in an agile environment
- Planned, operated, and successfully ran a fully remote three-day research presentation livestream

PRODUCT OWNER | FORD MOTOR COMPANY INTERNSHIP | MAY 2021 – AUGUST 2021

- Led a team of engineers and designers to create a charge management system for fleet electric vehicles (EVs) in an agile development environment
- Conducted industry research and competitive analysis regarding the fleet EV space to define a product plan
- Created customer personas through customer benchmarking with the goal of developing useful features
- Designed Algorithms and Processes to optimize charge usage, minimize recharge time, and lower the overall cost of owning an EV in fleets
- Split features into a progression state, creating a plan for a minimum viable product (MVP)
- Developed a clickable prototype demonstrating both the visual and technical feasibility of a charge management system

Skills & Awards

TECHNICAL SKILLS

- **Languages:** C++, C#, JavaScript, Fortran, PowerShell, Command Prompt, Html, CSS, Python, Bash
- **Operating Environments:** Microsoft Windows and Server, Ubuntu, Synology DSM
- **Software:** ROS, Docker, PyTorch, MATLAB, Simulink, SolidWorks, Git, OpenCV, System Center Configuration Manager, Active Directory, Hyper-V, Group Policy, SQL Server, Microsoft Deployment Toolkit, Microsoft Office, Git Hub, Adobe Photoshop, Visual Studio, OBS, Jira
- **Hardware:** 3D Printer Management, Computer and Server Assembly and Repair, Machine Assembly

AWARDS & ACHIEVEMENTS

- NSF Graduate Research Fellowship
- Henry Copeland Scholarship
- H. H. Chapman Award (top computer user)
- RRS Outstanding Senior
- Alabama Governor's School Attendee
- President's List (2018-2021)
- Evan K. Major, Jr. Award (top valedictorian)
- Advanced Placement Scholar
- IEEE Conference on Decisions and Controls (CDC) Student Support Award (2021)
- Institutional Review Board (IRB) Certification

Involvement

ORGANIZATIONS & ACTIVITIES

Current:

- Robotics Graduate Student Council Member
- The Institute for Electrical and Electronics Engineers (IEEE)
- IEEE Robotics and Automation Society (RAS)

Previous:

- Randall Research Scholars Program
- Randall Research Scholars Program freshman and CAD mentor
- Pi Tau Sigma – Mechanical Engineering Honor Society (President 2020 Vice-President 2021)
- Tau Beta Pi – Engineering Honor Society
- IEEE Control Systems Society (CSS)

Publications

JOURNAL PAPERS

J. Aldrich, C. A. Cousin, "Smoothly Switched Adaptive Torque Tracking for Functional Electrical Stimulation Cycling," IEEE Control Systems Letters, Vol. 6, pp. 866-871 (2021).

CONFERENCE PAPERS

J. Aldrich, C. A. Cousin, "Smoothly Switched Adaptive Torque Tracking for Functional Electrical Stimulation Cycling," IEEE Conference on Decision and Control, Austin, TX, December 2021.

J. Aldrich, C. A. Cousin, "Saturated Adaptive Control of Antagonistic Muscles on an Upper-Limb Hybrid Exoskeleton," American Control Conference, Atlanta, GA, June 2022.

OTHER PUBLICATIONS

Aldrich, Jace. Large Scale Motion Platform for Rehabilitation with Neuromuscular Stimulation and Virtual Reality. The University of Alabama, 2023.

Presentations

J. Aldrich, C. A. Cousin, "Smoothly Switched Adaptive Torque Tracking for Functional Electrical Stimulation Cycling," IEEE Conference on Decision and Control, Austin, TX, December 2021.

J. Aldrich, "Using Hybrid Exoskeletons for Muscular Rehabilitation," Randall Research Scholars Live, December 2019.

J. Aldrich, "Improving the Control of Functional Electrical Stimulation in Hybrid Exoskeletons," University of Alabama Undergraduate Research and Creative Activity Conference, April 2020.

J. Aldrich, "Improving the Control of Functional Electrical Stimulation in Hybrid Exoskeletons," Randall Research Scholars Live, December 2020.

J. Aldrich, "Saturated Adaptive Control of an Antagonistic Muscle Upper-Limb Hybrid Exoskeleton," Randall Research Scholars Research Symposium, April 2021.

Relevant Coursework

- ROB 550 – Robotic Systems Laboratory
- ROB 501 – Math for Robotics
- ROB 599 – Deep Learning for Robot Perception
- ROB 511 – Mobile Manipulation Systems
- ME 572 – Introduction to Robot Kinematics
- ME 556 – Mechatronics
- ME 577 – Advanced Linear Control
- ME 591 – Special Topics – Machine Learning
- ME 575 – Control Systems Analysis
- ME 594 – Special Project – Non-linear Control and Analysis