Ian Ruh

Undergraduate at the University of Wisconsin - Madison studying AMEP (Applied Mathematics, Engineering, and Physics), Computer Science, and Astronomy-Physics. Some of my areas of interest include robotics, controls, optimization, and space.

Education

2018–Present — **University of Wisconsin**, Madison, WI.
Currently a Senior pursuing a B.S. in AMEP (Applied Mathematics, Engineering, and Physics), Computer Science, and Astronomy-Physics.

Relevant Experience

Fall 2021 - Present — **Guidance, Navigation, and Control Intern**, Astranis, San Francisco, Ca.
Working on the orbit raise phase of operations, including trajectory planning, ground software, ground operations, and flight software, for the first operational satellite. Also working on low-thrust trajectory optimization to be used during orbit raise for the second block of satellites.

Summer 2021 — **DARTS Lab Intern**, Jet Propulsion Laboratory, Pasadena, Ca.
Developed a new mesh handling middleware for the DARTS simulation engine that unified the existing disparate implementations used throughout the codebase and extended their functionality to enable additional use cases, including collision detection, terrain modeling, CAD parts, soil modification, and graphics.

Spring 2020 - Summer 2021 — **Undergraduate Research Assistant**, TrustedCI, Madison, WI.
Performed first-principles security assessment of several HPC (high-performance computing) software projects, looking for violations of trust boundaries, exploitable bugs, and denial of service opportunities. Helped to develop course material on software security for use in industry workshops and academic classes, and assisted in presenting a tutorial at the Super Computing 2020 conference.

Summer 2019 — **Undergraduate Student Researcher**, Los Alamos National Laboratory, Los Alamos, NM.
Worked on optimizing an existing GPU accelerated simulation code (Cholla) for studying interstellar gas dynamics. I incorporated thermal conduction into the simulation's physics and implemented super time stepping to increase the speed at which the simulation could run. Utilizing this code, I performed simulations studying the competition between the classic Kelvin-Helmholtz instability and a recently discovered dynamical instability in interstellar gases.

Fall 2019 - Present — **Wisconsin Autonomous Team Leader**, UW Madison.
Wisconsin Autonomous is a student organization working on autonomous vehicles, currently competing in the evGrandPrix and the AutoDrive Challenge. As the leader of the software team, overseeing the perception, controls, estimation, and system integration teams, I work with the sub-team leaders on team objectives and coordination between teams in order to get the vehicle ready by competition time. As a member of the system integration team, I designed and developed of our vehicle software stack, including the ROS node architecture; telemetry and logging infrastructure; fault detection, isolation, and recovery system; and ground to vehicle communications.

Projects and Open Source Contributions

Swift MPC	Wrote, and continue to develop, a real-time capable MPC library. The system model can be specified in an intuitive and flexible manner, utilizing a symbolic mathematics library I wrote to automatically differentiate and manipulate the problem objective and constraints. In addition, the solver enables the user to easily customize the computation of the steps in the optimization problem, thus enabling the user to take advantage of the structure of problem to increase performance. (GitHub Link)
Low-Thrust Trajectories	For the final project of an optimization course, I worked on optimizing low thrust trajectories for transfers in two-dimensional two body systems via collocation. I discretized the dynamics of the problem to convert them into non-linear constraints and used Ipopt to solve the resulting NLP problem, while exploring the impact of various time and fuel based objectives. (Link)
LASwift	Contributed to expanding the interface to the BLAS/LAPACK linear algebra functions and ported the code base from Apple's Accelerate framework to general BLAS/LAPACK backends, allowing the library to add support for other OSes, in particular Linux. (GitHub Link)

Technical Skills

Languages	Python, C, Swift, Java, C++
Hardware	Arduino, Raspberry Pi, Jetson TK1 and Xavier
Other	ROS1, ROS2, Linux

Personal Interests

I am an avid mountain biker and cross country skier, and in addition enjoy gravel biking, trail running, hiking, bouldering, and ultimate.