ISAAC R. HARRIS
Control Systems Engineer | Metrea Aerospace
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SUMMARY

Control systems and robotics engineer with experience developing software for both aerospace and wearable robotics applications. Significant achievements in these fields include the design of a non-linear trajectory tracking controller for a cube satellite, and the design of an impedance controller for an open-source robotic leg.

Research interests: non-linear and digital control systems, trajectory generation, machine learning

EDUCATION

University of Michigan, Ann Arbor
Master of Science in Mechanical Engineering — *Sept 2020 – June 2021*
Concentration: Control Systems and Robotics
Coursework: Programming for Robotics in C, Digital Control System Design, Robot Kinematics and Dynamics, Linear Systems Theory

Bachelor of Science in Mechanical Engineering — *Sept 2017 – Dec 2020*
Senior Capstone: Led the electrical and software development of a 3 DoF gimbal instrumented with angle encoders. Responsibilities included sensor, battery, and microcontroller selection, integration of the final electronics board, and firmware creation using C++

Coursework: Automatic Control Systems, Design/Control of Wearable Robotics, Modeling and Control of Dynamic Systems, Instrumentation and Experimental Techniques (using electronics), Probability and Random Processes

EXPERIENCE

Metrea Vantage Labs
Control Systems Engineer — *May 2021 – Present*

- Translated mission CONOPs into control and estimation requirements and subsequently selected actuator and sensors based on derived requirements
- Responsible for analysis, design, and testing of MIMO satellite attitude and determination algorithms in Python. Algorithm experience includes nonlinear trajectory tracking controllers, Kalman filters, and detumble controllers
- Wrote embedded C/C++ for sensor drivers and communication protocols to support core Avionics stack
- Participated in regular code reviews and scrums as part of agile development framework

University of Michigan, Locomotor Control Systems Lab | Neurobionics Lab
Graduate Research Assistant — *Sept 2020 – May 2021*

- Used Python in a Linux development environment to model and simulate a disturbance observer (DOB) control algorithm for a series elastic actuator (SEA) on a robotic knee prosthesis
- Designed an embedded state space controller in Python to validate SEA simulation results on hardware which included two BLDC motors, a torsional spring and a high power LiPo battery
- Co-presented control seminar to Google X wearable robotics team

University of Michigan, Sienko Research Lab
Undergraduate Research Assistant — *May 2020 – Aug 2020*

- Ma, C.Z.-H.; Bao, T.; DiCesare, C.A.; **Harris, I**.; Chambers, A.; Shull, P.B.; Zheng, Y.-P.; Cham, R.; Sienko, K.H. Reducing Slip Risk: A Feasibility Study of Gait Training with Semi-Real-Time Feedback of Foot–Floor Contact Angle. Sensors **2022**, 22, 3641.
- Contributed to the publication above by developing pipelines and biomechanical models in Vicon Nexus and Visual 3D software to process and analyze optical motion capture data

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EXPERIENCE

University of Michigan, Neurobionics Lab
Undergraduate Research Assistant *May 2018 – April 2020*

- Integrated firmware for high torque BLDC motor into a MATLAB GUI allowing for benchtop testing of various control schemes including position control and impedance control
- Implemented white noise system identification techniques on BLDC motor coupled to spur gear transmission and obtained plant transfer function
- Aided in debugging hardware and software issues during human subject testing of a mechatronic ankle prosthesis
- Created a state machine to control the robotic ankle's motor and display various sensor output using Python and Bash on a Raspberry Pi computer

SKILLS

- Software: Simulink, Git, LTspice, Solidworks, CATIA, Vicon Nexus, Visual 3D
- Code Languages: C/C++, Python, MATLAB, Bash
- Manufacturing: Mill, Lathe, 3D printer, Laser Cutter, Water Jet, GD&T