

# Nick Cline

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## EDUCATION

**University of Massachusetts, Amherst, MA**

May 2022

*B.S., M.S. in Mechanical Engineering | GPA 3.49/4.0*

*Minor in Computer Science*

## RESEARCH EXPERIENCE

**University of Massachusetts Amherst HRSL, Amherst, MA**

Dec 2021 – May 2022

*Graduate Researcher*

- Created control scripts in python to implement custom impedance control loops for a robotic hip exoskeleton using the FlexSEA API on Linux.
- Applied asymmetric stiffness to human gait to study behavioral adaptations to a resistant exoskeleton torque. Compiled and analyzed data from motion capture and ground reaction forces to identify key trends and possible neuro-motor impacts.
- Used findings to evaluate the gait patterns resulting from the exoskeleton's impedance with results published in IROS 2022.
- Identified new control schemes for gait control, documenting and testing the initial implementation. Takeaways from the experiments were used to develop tools for realtime data analysis and an improved setup process.

## WORK EXPERIENCE

**Draper Laboratory, Cambridge, MA**

Aug 2022 – Present

*Mechanical Instrumentation Engineer II, Software Developer*

- Developed innovative design features for a sensor assembly, playing a key role in a cross-functional team by exploring trade spaces and implementing solutions.
- Led significant project design reviews, with the goal of tracking performance and meeting strict requirements.
- Designed and tested production prototypes, analyzing test data to identify areas for revision and validate production processes for critical assembly features.
- Programmed modular data visualization tools for detailed analysis of data, implemented tools for improving program automation.

## PROJECT EXPERIENCE

### Robotic Simulation

- Built a Furuta pendulum model for use in Gazebo and Drake, controlled with C++ scripts and ROS 2. Developed swing-up and energy-minimizing controllers to stabilize pendulum. Future implementations include reinforcement learning based control of the pendulum and double pendulum control.
- Created a bipedal robot model in Gazebo and used Julia to output inverse dynamics from the system configuration. Future implementations include full-body control of the bipedal robot.

### Robotic System Design

- Designed and prototyped cycloidal and planetary gearboxes for use with brushless DC motors. Tested prototypes using speed control and iterated on design to improve assembly and strength.
- Produced a benchtop dynamometer prototype to compare performance and characteristics of two competing DC motors. 3D printed the mechanical components of the dynamometer with a focus on rigidity and assembly.

### Areas of Expertise

- Expert in 3D Printing, Solidworks, Python, MATLAB, and robotic design. Working knowledge of C, C++, Rust, Julia, ROS, Gazebo, Drake and Reinforcement Learning.

## PUBLICATIONS

Price, M., Abdikadirova, B., Locurto, D., Jaramillo, J. M., **Cline, N.**, Hoogkamer, W., & Huber, M. E. (2022). Unilateral stiffness modulation with a robotic hip exoskeleton elicits adaptation during gait. In 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (pp. 12275–12281). IEEE. <https://doi.org/10.1109/iro47612.2022.9981067>

## SKILLS & INTERESTS

**Skills:** Atlassian Suite, C, C++, Python, Rust, Julia, MATLAB, Solidworks, ROS 2, Gazebo, Drake, MPC, Nonlinear Dynamics, OpenCV, Git, LaTeX.

**Interests:** Robotics, Machine Learning, AI, 3D Printing, Gardening, Cooking, Weightlifting.