# Lincoln Roth

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## EXPERIENCE

### Embedded Firmware Engineer
*Second Order Effects*

May 2022 – Present

*El Segundo, CA, Redmond, WA*

- Led firmware development for diverse consulting projects in deep tech industries, including fusion energy, satellites, medical devices, and rocket propulsion. Contributed to the refinement of firmware team culture and development processes by improving the Software Development Plan, creating technical documentation, and training new engineers.
- **Space-Rated SSD Firmware**: Designed and implemented the flash translation layer for a space-grade SSD, achieving sustained read speeds **over 1500 MBps** through a **custom data striping architecture** that **improved throughput by 500**%. Developed a bespoke bad block management algorithm that doubled the speed of conventional methods. Integrated and optimized the **lwIP** stack, reducing BRAM usage to improve FPGA place-and-route performance despite the resource-heavy ONFI IP core. Built a **high-speed test system to benchmark and validate** SSD performance under mission-critical conditions.
- **EtherCAT Sensing and Compute Platform**: Led the firmware development for an EtherCAT-based sensing and compute platform, architecting a CLI application for real-time telemetry and command over UART and fiber-based EtherCAT. Drove the project to completion over **two months ahead of schedule, securing a follow-on contract** for production support and EtherCAT testing, **saving the company over $500k** in projected costs. Managed firmware development and team coordination, delivering a robust, production-ready system while **overseeing the full development lifecycle** and acting as the primary firmware contributor.

### Mechatronics Engineering Intern
*ASML*

June 2021 – August 2021

*Wilton, CT*

- Designed and implemented diagnostic tools in MATLAB/Simulink to analyze the dynamic behavior of the Reticle Handling system, enabling faster robot movements while minimizing vibrations.
- Developed and integrated control algorithms into the internal control structure to enhance vibration compensation and improve system response, increasing throughput and system reliability.

### CUDA Research Assistant
*Rutgers University Aresty Research Center*

Sep. 2020 – May 2021

*New Brunswick, NJ*

- Used **parallel processing and CUDA acceleration** with MATLAB to improve processing speed of a 3D insect flight simulator used for development of micro-aerial robots.This allows for **over 50x increases in program speed** greatly reducing computational costs associated with simulation

## EDUCATION

### Rutgers University

New Brunswick, NJ

*Bachelor of Science in Mechanical Engineering and Computer Science*

## PROJECTS

### Robotics-specific prototyping actuator | *STM32, EAGLE, CAD, C, Control Systems*

- Designed and built a high-torque density custom servomotor specifically designed for rapid robotics development. Used hobby BLDC motors in a quasi-direct drive setup paired with a high power motor control platform and FOC control. Allowed for very fast, high precision motion, in a modular form factor greatly reducing the needed work on many other projects.

### Firefighting robot | *ROS, Gazebo, Python, Linux/Yocto, C, Robotics*

- Built a firefighting robot for the Trinity International Robot Contest. The robot was built to autonomously navigate a maze to find and extinguish a fire. The robot used custom servos for locomotion, a 2D Lidar and an IMU for localization, as well as a host of other sensors and actuators for detecting and extinguishing the flame

## TECHNICAL SKILLS

**Software**: C/C++, Python, Rust, MATLAB/Simulink, ROS(2), Linux (Yocto), CMake, Make, Git, CI/CD, Verilog/SystemVerilog
**Embedded**: ARM Cortex (STM, TI, NXP), FPGAs/SoCs (Xilinx, Microchip), RTOS (FreeRTOS, Zephyr), Ethernet (lwIP, UDP/TCP/IP), EtherCAT, Embedded Testing Frameworks
**Electrical**:KiCAD, Altium Designer, Soldering/Rework (SMD), PCB Bring-up, NAND Flash