Nathan Chun

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EDUCATION

University of Southern California Los Angeles, CA

Bachelor of Science in Mechanical Engineering, Minor in Artificial Intelligence Applications *Aug. 2022 – May 2026*

Relevant Coursework GPA: 3.95

Linear Control Systems, Mechanics of Materials & Structures, Materials Behavior & Processing,
Applied Natural Language Processing & Gen AI, Measurement & Instrumentation Lab, MEMS, Optimal Control

EXPERIENCE

USC Dynamic Robotics and Control Lab | Provost & CURVE Fellow Los Angeles, CA

Humanoid Pose Optimization | Demonstration Video *May 2025 – Present*
- Implemented kinodynamic pose optimization and MPC with 6 ROS2 packages to control HECTOR v2
- Simulated in **MuJoCo** to debug and ensure expected behavior

Teleoperated Construction Robotics | Demonstration Video *Aug 2024 – Present*
- Developed **ROS2** & Gazebo simulation on Linux with barrier avoidance to demonstrate enhanced user safety
- Implemented 2-stage control framework with **RRT*** path planning algorithm and joy stick modes
- Explored **LiDAR** sensor configurations & utilized point cloud data for object detection & avoidance
- Investigated encoder integration for joint tracking to transition from simulation to real hardware

HECTOR Humanoid v2 | More about HECTOR v2 *Aug 2023 - Aug 2024*
- Designed 8+ iterations of control board PCB to manage **RS485, CAN, & ethernet** communication
- Advised on **PCB design** and analyzed data sheets to ensure proper usage of electronics for signal integrity
- Coordinated with electrical and mechanical team members to ensure compatibility between systems
- Tracked and documented iterative design changes using Git version control

Robotic Quadruped Arm *June 2024 - July 2024*
- Engineered robotic arm mounted on 2 Unitree Go1 quadrupeds for collaborative manipulation of large objects
- Collaborated with PhD team to ensure arm design met research needs; finalized in 2 weeks

Wheelchair Stabilizer | Demonstration Video *Jan 2023- Sept 2024*
- Designed 4 prototypes of an automated wheel for wheelchairs, accounting for ease of use, cost, and compactness
- Slashed material cost and weight by 50% using **ANSYS** stress and topology optimization and low-cost sensors
- Specified, tested, and assembled **embedded system** to control motorized wheel with low-cost components
- Proved concept with **Simulink** and **MATLAB** to model control system and simulate stabilizer triggering

USC Viterbi Baum Family Makerspace May. 2024 – Present

CNC Machinist/Student Worker/Roboticist *Los Angeles, CA*
- Operating & programming manual & HAAS **CNC mills** & **lathes** using **MasterCAM** for USC design teams
- Identified opportunities to operate **waterjet** and **bandsaw** for efficient fabrication of lower tolerance components
- Created **GD&T** drawings for designed parts including custom fixtures to allow replication by other machinists
- Proposed design for manufacturing (**DFM**) practices & designed tools (e.g. fixtures) to facilitate machining

USC John O'Brien Nanofabrication Lab Jun. 2025

SURF Intern & Fellow *Los Angeles, CA*
- Fabricated MEMS devices with **photolithography**, wet & dry **etching**, **chemical deposition**, etc.

Projects

Cart Pole Pendulum | *Optimal Control, MATLAB/Simulink, Embedded Systems, Fabrication* July 2025
- Simulated CartPole stabilization after perturbation with **LQR** controller
- Designed, manufactured, and assembled physical system for $170 in less than 2 weeks
- Devised empirical methods to determine conversions between controller outputs and physical system commands

Desktop CNC Router | *CNC Milling, Waterjet, CAD* Apr 2025 – May 2025
- Designed structural components based on available scrap metal sizes to simplify manufacturing and cut costs
- Utilized spare aluminum extrusion and low-cost linear guide rails for rigid, precise travel along y & z axes
- Programmed and operated HAAS VF-2 and **waterjet** to manufacture and assemble all custom parts

Analysis of Fin Separation on Heat Transfer | *LabVIEW, Data Processing* Apr 2025 – May 2025
- Proposed experimental design outlining required data, equipment, theory, and expected results
- Programmed custom VI in **LabVIEW** to automate **thermocouple** data plotting
- Applied heat transfer fin theory and compared experimental to real world results

MEMS Pressure Sensor | *LabVIEW, Sensor Integration, Data Analysis* Apr 2025 – May 2025
- Employed **strain gauges** to read pressure, achieving accurate readings between 0.5 and 1.5psi
- Ran multiple trials to empirically determined relation between strain and pressure
- Presented results and performed **error analysis** to determine root cause of inaccuracy at higher pressure

Energy-Generating Shoes | **USC Makers** | *Circuits, MEMS Sensors, Prototyping* Jan 2023 – May 2023
- Investigated energy harvesting technology and boost converters to step up low voltage from piezoelectric effect
- Experimented with various insole materials & placement of piezoelectric crystals for highest voltage generation

Publications

A. Rigo, J. Ma, **N. Chun**, S. Gupta, Q. Nguyen, "Hierarchical Control Framework for Collision-Free Collaborative Loco-manipulation of Large and Heavy Objects," *IEEE International Conference on Automation Science and Engineering (CASE)*, 2025.

Talks

1. USC CURVE Symposium, *Hardware Development for Affordable Humanoid Robots*, 2024.

Technical Skills

Languages: English (Native), Mandarin (Fluent)
Software: C++, Python, MATLAB, Simulink, Wolfram Mathematica, ROS, Julia, GitHub, Excel
Mechanical: SolidWorks, NX, ANSYS, FEA, 3D Printing, DFM, GD&T, CNC, Material Selection, Manufacturing
Electrical: PCB Design (KiCad), Soldering, Arduino, EPS32, Teensy 4.1, Oscilloscope, Multimeter, Logic Analyzer