Gregory Xie

Cambridge, MA | gregory.w.xie@gmail.com | gregoryxie.com |

Full-stack roboticist focusing on manipulator design, with experience spanning from mechanism design to modeling and control. Expert at optimizing high performance robots by systems integration and tightly coupling electromechanical design to software and controls.

Experience

Roboticist | Robotics and AI Institute | Cambridge, MA *June 2023 - Present*

Technical lead for the design of high-performance robotic hands and wrists for dynamic, bimanual manipulators, owning decisions from concepts through detailed drawings and integration.

- Designed underactuated and fully articulated tendon-driven hands (6-12 DoF) with integrated tactile sensing, enabling robust grasping and fine manipulation
- Designed a robotic forearm housing a compact 2-DoF parallel wrist and finger actuators, balancing strength, weight and packaging constraints. Optimized structure for weight using finite element analysis
- Designed rotary and linear quasi-direct drive finger and wrist actuators (20-40 mm diameter), enabling compliant yet forceful manipulation behaviors
- Developed simplified models to study the effects of friction, mass, and latency on the dynamic performance of robot hands, informing actuator, transmission, and sensor design
- Developed simulation tools to evaluate hand morphologies and kinematics
- Performed workspace analysis and trajectory optimization for a bimanual manipulator, determining kinematic parameters, motor sizing, gearing, bearing selection, and power system requirements
- Created detailed part drawings using GD&T, performed tolerance analyses to ensure accurate and repeatable assemblies
- Held regular design reviews with researchers from across multiple projects to incorporate stakeholder requirements

Graduate Research Assistant | MIT CSAIL | Cambridge, MA *Sep 2022 - May 2023*
Undergraduate Research Assistant *June 2019 - June 2021*

- Designed robotic grippers for in-hand manipulation and grasp proprioception, resulting in peer-reviewed publications
- Designed modular expanding robots enabling novel swarm locomotion behaviors, resulting in peer-reviewed publications

Robotics Software Engineering Intern | Realtime Robotics | Boston, MA *Sep 2022 - May 2023*

- Developed motion planning, filtering, and simulation features for a planning stack interfacing with industrial robot arms

Mechatronics Intern | Nimble Robotics | San Francisco, CA *June 2021 - Aug 2021*

- Wrote firmware for BLDC motor drivers, improving actuator torque accuracy and field weakening performance
- Built electromechanical and thermal models of actuators using dynamometer testing
- Diagnosed and resolved intermittent failures of actuator CAN bus, improving robot reliability

Mechanical Engineering Intern | Formlabs | Somerville, MA *June 2020 - Aug 2020*

- Designed and ran lifetime and design verification tests for the Form Wash L and Form Cure L
- Created detailed part and assembly drawings

Patents and Publications

[1] **Xie, G** and Rojas, N. Wrist Mechanism for a Robot Arm U.S. Patent Application 19/043,948, filed February 3, 2025.

[2] Chin, L., **Xie, G.**, Lipton, J., Rus, D. “Large-Expansion Bi-Layer Auxetics Create Compliant Cellular Motion” in *IEEE ICRA.* 2025

[3] **Xie, G.**, Chin, L., Kim, B., Holladay, R., Rus, D. “Strong Compliant Grasps Using a Cable-Driven Soft Gripper” in *IEEE IROS.* 2024

[4] **Xie, G.**, Holladay, R., Chin, L., Rus, D. “In-Hand Manipulation With a Simple Belted Parallel-Jaw Gripper” in *IEEE RA-L.* 2024

[5] Chin, L., Burns, M.*, **Xie, G.***, Rus, D. “Flipper-Style Locomotion through Strong Expanding Modular Robots” in *IEEE RA-L.* 2023

Education

Massachusetts Institute of Technology *2022 - 2023*
M. Eng. in Electrical Engineering and Computer Science (GPA: 5.0/5.0)

Massachusetts Institute of Technology *2018 - 2022*
B.S. in Electrical Engineering and Computer Science and B.S in Mechanical Engineering (GPA: 5.0/5.0)

Skills

Robotics	Robot kinematics, modeling, computational design optimization, MuJoCo, Drake
Programming	Python, C++, MATLAB
Mechanical and Electrical	CAD (Solidworks, Onshape), FEA (Ansys), GD&T, DFM/DFA, KiCAD, LTSpice
Fabrication	CNC and manual machining, 3D printing, laser and waterjet cutting, soldering

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📱
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Experience

Robotics and AI Institute *June 2023 - Present*
Roboticist

- Designed tendon-driven, underactuated and fully articulated hands with tactile sensing, ranging from 3-9 actuators and 6-12 DoF deployed on an internal manipulation platform
- Designed a forearm with a 2 DoF parallel wrist and also housing finger actuators, used FEA to optimize for size, weight, and strength using loads extracted from robot simulations
- Designed and integrated rotary and linear quasi-direct drive finger and wrist actuators ranging from 20 - 40mm in diameter enabling compliant and powerful manipulation behaviors
- Designed a handheld, hand evaluation platform allowing for quick evaluation of hands via grasp synergy based teleoperation
- Performed workspace analysis and optimization for a bimanual manipulator, optimized motor sizing/gearing and determined design requirements (structure and bearing loads, power supply impedance, etc) through trajectory optimization
- Developed simplified models to investigate the effects of various parameters (friction, mass, latency, etc) on the dynamic performance of hands
- Developed simulation tools to evaluate candidate hand morphologies and kinematics
- Created detailed part drawings using GD&T, performed tolerance analyses to ensure accurate and repeatable assemblies

MIT CSAIL (PI: Prof. Daniela Rus)
Graduate Research Assistant *Sep 2022 - May 2023*
Undergraduate Research Assistant *June 2019 - June 2021*

- Designed two robotic grippers for in-hand manipulation and grasp proprioception, resulting in publications [3, 4]
- Designed modular expanding robots, resulting in publications [2, 5]

Realtime Robotics *Sep 2022 - May 2023*
Robotics Software Engineering Intern

- Developed planning, filtering, and simulation features for a motion planning stack interfacing with industrial robot arms (Kuka, Fanuc, Mitsubishi, etc)

Nimble Robotics *June 2021 - Aug 2021*
Mechatronics Intern

- Wrote firmware for BLDC motor drivers, improving actuator torque accuracy and field weakening performance
- Built electromechanical and thermal models of actuators using a dynamometer

Formlabs *June 2020 - Aug 2020*
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Areas of Expertise

Mechanical and Electrical	**CAD (Solidworks, Onshape), FEA (Ansys), GD&T, DFM/DFA, KiCAD, LTSpice**
Programming	**Python, C++, MATLAB**
Robotics	**Robot kinematics, modeling, computational design optimization, MuJoCo, Drake**