Bill Fan

Robotics Researcher

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EDUCATION

Olin College of Engineering **Needham, Massachusetts**
Bachelor of Science in Engineering: Robotics *June 2024*
- Recipient of 4-year, 50% tuition Olin Merit Scholarship

RESEARCH EXPERIENCE

University of Massachusetts, Amherst *Summer 2023 - current*
Advisor: Gina Olson
- Developed a novel algorithm for 20x faster computation of a soft robot's feasibility of completing specified tasks.
- Characterized novel soft robot actuators by designing test fixtures and software to simplify and speed up testing.
- Implemented continuum arm simulations and compared different arm design parameters against specified tasks.

This work is in preparation for submission to IEEE International Conference on Robotics in fall 2024.

Olin College of Engineering *September 2021 - Summer 2023*
Advisor: Melinda Malley
- Founded a student research group with 10 members to design, control, and motion capture novel soft robot systems.
- Created soft robot arms based on snake and octopus muscle structures to validate novel biomechanics models.
- Published and presented experiment results at Robosoft - the only undergraduate attendee invited to deliver a talk on stage.
- Secured $7,500 total funding for the research group through campus grant proposals and research result reports.

This work resulted in a publication and oral presentation at IEEE Robosoft 2023. 3rd best poster at workshop.

Oregon State University Robotics *Summer 2021*
Advisor: Ross L Hatton
- Derived a novel linear muscle mechanics model for robot snakes and octopuses using coordinate-free differential geometry.
- Created extensible Matlab implementation of the model and simulated arms with varied muscle structures in 2D and 3D

This work resulted in a publication and oral presentation at IEEE Robosoft 2023. 3rd best poster at workshop.

Olin College of Engineering *October 2020 - May 2021*
Advisor: David Barrett
- Developed visual-inertial UKF based Apriltag-SLAM to enable underwater localization of a robotic tuna fish.
- Constructed Gazebo and Matlab 3D motion simulations to create ground-truth pose trajectory data to validate algorithms.
- Collected video datasets of underwater vehicles navigating amongst Apriltags to validate algorithms.

PUBLICATIONS

Beyond "How's it going?": A Collaborative Autoethnographic Study by Early Instructors in a First-Year Engineering Studio Course *ASEE 2024*
Esme E Abbot, Berwin Lan, Luke Raus, ***Bill Fan****, Zachary del Rosario*

Linear Kinematics for General Constant Curvature and Torsion Manipulators *Robosoft 2023*
Bill Fan*, Farhan Rozaidi, Capprin Bass, Gina Olson, Melinda Malley, Ross L Hatton*
- Presented poster and lightning talk at Robosoft 2023. Won third-place best poster at a workshop.

INVITED TALKS

Conference Presentations
Robosoft 2023, lightning talk - *"Linear Kinematics for General Constant Curvature and Torsion Manipulators"* *April 2023*

Seminars
UMass Amherst, Robotics Journal Club - *"Reinforcement Learning in Soft Embodiments"* *June 2023*
Olin College of Engineering, Community Research Seminar - *"The Geometry of General McKibben Arms"* *March 2023*

TEACHING

Controls - *Course Assistant* *Spring 2022 & 2024*
- Designed a magnetic levitation final project system and prepared kits for a class of 17 students.
- Hosted office hours, tutored students 1-on-1, and graded all problem sets for the class.

Modeling and Simulation in the Physical World - *Head Course Assistant* *Fall 2023*
- Studio instructor of a computational modeling course for first-year engineering students, supervised by Prof. Allison Wood.
- Worked with three other CAs to teach in classrooms, design new course material, grade, and host office hours.
- Performed meta-analysis of the new studio instructor experience with three other CAs, results published in ASEE 2024.

Quantitative Engineering Analysis 3 - *Course Assistant* *Fall 2022*
- Sole in-class course assistant for a studio-style course on ODEs with 80+ second year students.

Identity from the Mind and Brain - *Writing Tutor* *Fall 2021 & 2022*
- Tutored students on concepts and worked on essays for a first-year seminar on personal identity, psychology, and philosophy

OUTREACH

Dearborn STEM Academy - *Collegiate Partner* *Fall 2023 - Summer 2024*
- Created in-class and after-school STEM activities for students at a Boston public school in a team of 8 Olin students.
- Worked with three 10th grade students to collaboratively launch an after-school makerspace. Mentored the students in the operation and maintenance of 3D printers and simple shop tools.
- Met with students, teachers, parents, and admin to perform stakeholder-engaged design, and shared resulting reports.

INDUSTRY EXPERIENCE

XGenomes *June 2024 - Present*
Engineering Co-op
XGenomes is developing a revolutionary single-molecule genome sequencing technology
- Enabling long-read single-molecule imaging of DNA bases by designing a microfluidic DNA-stretching system.
- Analyzing electrochemistry of DNA electrophoresis to facilitate wet lab experiments for testing the microfluidic system.
- Reduced cost of custom microfluidic flow-cells by 90% by developing in-house 3D printing workflow based on literature.

Dusty Robotics *Summer 2022*
Robotics Software Intern
Dusty Robotics is leveling up the construction process by printing building CAD files for entire floors to within 1mm accuracy.
- Created Python and C++ motion capture tools to analyze datasets with millions of robot poses against ground-truth.
- Applied said tools to demonstrate the redundancy of an expensive robot sensor, reducing robot costs by $10,000 each.
- Implemented 3D sensor integration in the robot's factor graph state estimator to improve navigation in sensor-deprived spots

Detroit Electric Boats *May 2020 - October 2020*
Controls Engineer
Detroit Electric Boats was a startup building an electric autonomously hydrofoiling catamaran.
- Modified a standard catamaran hull with motors and control electronics to enable autonomous control of hydrofoiling.
- Implemented cascading PID control of a hydrofoiling catamaran, capable of achieving multiple minutes of air time.
- Created a Gazebo simulation of the hydrofoiling boat to enable offline testing of the control system. The controller developed using the simulation transferred to the real world on its first try
- Performed design reviews and oversaw manufacturing of custom hardware and electronics.