Michael Burgess
Robotic Manipulation @ MIT

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Education

2023 - 2025	**Massachusetts Institute of Technology (MIT)**	Cambridge, MA
	M.S. in Mechanical Engineering	GPA: 5.0 / 5.0
	*Advisor: Edward Adelson	Focus: Robotic Manipulation & Tactile Sensing*	
2018 - 2023	**Massachusetts Institute of Technology (MIT)**	Cambridge, MA
	B.S. in Mechanical Engineering	GPA: 5.0 / 5.0
	Courses: Underactuated Robotics, Bio-inspired Robotics, Dynamics & Control	

Technical Skills

Software	*Concepts:*	Machine Learning, Computer Vision, Controls, RL, Algorithms, App Dev
	Languages:	Python, C++, Matlab, Drake, Isaac Gym, Javascript, Typescript, React, Git
Hardware	*CAD:*	Solidworks, Autodesk, ANSYS, Fluids, Statics, FEA / CFD Simulation
	Machining:	CNC, Lathe, Waterjet, 3D Printing, Injection Molding, Laser Cutter
	Electrical:	Arduino, Raspberry Pi, Circuit Analysis, Simulink, Soldering

Professional Experience

May 2023 - Aug. 2023 — **Commonwealth Fusion Systems** / *Mechanical Engineering Intern*
- Modeled parts for magnet subsystems on a novel tokamak nuclear fusion reactor using NX and ANSYS software. Specifically designed supports for poloidal field (PF) coils.
- Key takeaways from the internship were skills in electromechanical analysis, communication of results, modeling techniques.

Jan. 2022 - May 2023 — **MIT Biomimetic Robotics Lab** / *Undergraduate Researcher*
- Performed research on locomotive trajectory planning over non-flat terrain for a quadruped (cheetah-like) robotic system.
- Developing a novel controller that decouples kinematic and dynamic constraints to empower online planning over rough terrain.

May 2022 - Aug. 2022 — **Markforged** / *Software Engineering Intern*
- Wrote simulated annealing based algorithm to improve printer bed packing, thereby increasing number of parts per print. All code was written in Typescript.
- Learned communication-based soft skills through the responsibility of running meetings and giving presentations.

Jan. 2021 - May 2021 — **NASA Langley Research Center** / *Engineering Intern*
- Optimized convolutional neural networks (CNN) that estimate where a fluid flow becomes turbulent along the surface of an airfoil.

	-	Incorporated these models into flight simulation CFD solvers for practical use in minimizing viscous drag.
Sept. 2020 - Jan. 2021	**Scientific Systems Company, Inc**. **(SSCI)** / *Robotics Intern*	
	-	Designed and tested a role-specific control system for UAV fleet with behavior responsive to user input.
	-	Researched and developed state-of-the-art attention-based, reinforcement learning (RL) models using OpenAI gyms, Tensorflow, and PyTorch.
May 2020 - Aug. 2020	**General Motors (GM)** / *Controls Engineering Intern*	
	-	Automated standard hardware-in-the-loop test cases for engine controller software using tools in Python and dSpace.
	-	Built code libraries to locate and diagnose errors across cars' control communication infrastructure, written in C code.

Publications

[1] **Michael Burgess**. "Decoupled Kinodynamic Planning for a Quadruped Robot over Complex Terrain". In: *MIT dSpace (2023)*. URL: https://dspace.mit.edu/handle/1721.1/151851.

[2] Nicholas Ramirez, **Michael Burgess**. "Robotic Arm Manipulation to Perform Rock Skipping in Simulation". In: *arXiv:2310.11599 (2023)*. URL: https://arxiv.org/pdf/2310.14492.pdf.

[3] **Michael Burgess**. "Hybrid Trajectory Optimization of Simple Skateboarding Tricks through Contact". In: *arXiv:2310.11599 (2023)*. URL: https://arxiv.org/pdf/2310.11599.pdf.

Activities

Jan. 2020	**MIT Global Teaching Labs (GTL)**	Rho, Italy
	- Spent a month in Rho, Italy teaching robotics concepts to high school students.	
	- Created and taught my own curriculum of circuits and PID control systems, including lectures, exams, and experiments with Arduino.	

Portfolio

Dec. 2022	**Rock Skipping Robot**
	- Developed a control architecture and simulation environment to perform the task of rock skipping on a Kuka IIWA robot arm, using Drake.
	- Project required knowledge in trajectory optimization, fluid physics, and robotic simulation techniques.
Dec. 2022	**Hula Hooping Robot**
	- Designed, built, and controlled a 2 DoF robot system that was capable of hula hooping, in order to study how humans are able to hula hoop most effectively.
	- Project required use of Matlab, embedded controls, and hardware design.
May 2022	**Underactuated Skateboard Control System**
	- Created a trajectory planner using non-linear hybrid dynamic optimization to perform skateboard tricks in simulation on an abstracted skateboard-rider system.
	- Project was written using Drake and required knowledge of non-linear controls.

For a full portfolio, please visit my website at mburgjr.github.io/portfolio/.