Ethan Chandler

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Education

- **Worcester Polytechnic Institute** — *Bachelor, Master of Science: Robotics Engineering* *Expected – May '25*

Related Coursework: *Legged Robotics, Robot Control, Motion Planning, Robot Dynamics, Swarm Robotics, Artificial Intelligence*

Skills Summary

- **Software**: Proficient in C++, C, Python, MATLAB, OpenCV, ROS/ROS2, Linux, Bash; Familiar with Java, JS, HTML
- **Hardware**: Skilled in CAD/CAM (Fusion360, Inventor & SOLIDWORKS), PLC, 3D Printing, Breadboarding
- **Aptitudes**: Experienced in Legged Robotics, Optimal Controls, Machine Learning, Computer Vision

Related Experience

- **TA at WPI** — *Graduate Teaching Assistant* *Dec '24 – Present*
  - **RBE 521 Legged Robotics**: TA and grader, tasked with redesigning the entire course from scratch. Includes writing 14 weeks' worth of lesson plans in state-of-the-art legged robotics, with a focus on robust loco-manipulation
- **Optimal Control of Legged Robots** — *Graduate Research* *Aug '22 – Present*
  - **Pseudospectral Collocation Framework for Legged Robots**: I developed Galileo, a lightweight C++ library for trajectory optimization using Gauss-Legendre Pseudospectral Collocation. It enables solving problems written in Bolza form, which could include legged robot acrobatics, energy-efficient drone trajectories, and maze navigation for differential drive robots. As a case study, Galileo achieves real-time locomotion for quadrupedal walking on a Unitree Go1
  - **Push Recovery by Stepping**: Created a novel push recovery controller for WPI's custom bipedal robot, HURON, which allows it to recover from external disturbances by taking a step. The controller uses the centroidal dynamics to optimize the COM and joint trajectories, which are then fed to a custom WBC to compute joint torques
  - **Legged Acrobatics**: Used direct collocation to make a simulated Solo-12 perform backflips, corkscrews, and barrel rolls. Improved upon other techniques by reformulating orientation dynamics and using a custom initial guess strategy
  - **Solo-12 Quadrupedal Locomotion**: Designed a control schema for dynamic locomotion of the Solo-12 quadruped. A linearized lumped-mass model is fed to MPC to find foot reaction forces that satisfy a desired CoM trajectory, while a WBIC imposes floating base constraints to solve a QP problem and find the joint torques to satisfy the forces found by MPC. Adaptive impedance controller computes the commanded torques, accounting for the model's inertial uncertainty
- **Swarm Robotics** — *Graduate Research* *Dec '22 – May '23*
  - **Distributed Systems and Intermittent Communication**: Created an algorithm to control connectivity dynamics such that agents take optimal actions to allow for communication between potentially disjointed groups, and merge/split from groups when necessary to optimize network throughput while adhering to physical constraints such as signal range. Emergent behavior with 20 Khepera IV robots created a 'bridge' between clusters
- **Motion Planning and Controls** — *Undergraduate Research* *Nov '21 – May '23*
  - **Optimization over Composable Action Sets**: Split the state space of a LIP into polytopic 'action sets', and used linear constraint satisfaction to identify the appropriate sequence of actions a trajectory should traverse. Once the sequence of actions is found, direct collocation is performed. Method solved problems that were previously infeasible
  - **Multi-Resolution Field D* for Mobile Robot Path Planning**: Developed optimizations to the Field D* algorithm by introducing a memory-based heuristic and improving cost estimation of multi-resolution neighbors
  - **Parallelized Quadtrees and Efficient Neighbor Finding on Adaptive Hilbert Curves**: Programmed a C++ quadtree framework which enumerates cells onto an adaptive Hilbert curve, and uses a novel algorithm for mesh refinement. Closed-form solution allows the quadtree to be refined in parallel on GPU for SLAM and path planning
  - **Mobile Robot Framework**: Developed a comprehensive autonomous mapping & navigation stack in C++. Identified frontier clusters using RRT's & HDBScan, and used my optimized Field D* as a continuous cost function for DWA to identify optimal inputs to drive the robot to arbitrary target states in a massive, multi-resolution, dynamic environment
- **Embedded Programming** — *Undergraduate Projects* *Aug '21 – Mar '22*
  - **MSP430 Guitar Hero**: Developed a Guitar Hero game on MSP430 in C. Real-time animation of piano keys on LCD
  - **ABB IRB 1600**: Used RobotStudio and PLC ladder logic to perform palletizing operations at high speeds
- **Manipulators** — *Undergraduate Projects* *Aug '21 – Mar '22*
  - **Serial Arm**: Programmed 3-DOF arm with Matlab & Java to dynamically track & manipulate objects using CV
  - **Rigid Body Library**: Created a Matlab library for efficient rigid body kinematics and dynamics to generate symbolic kinematics (DH and POE) and dynamics (Lagrange Method and RNEA) based on URDF model parameters
- **BattleBots** — *Builder for Axolotl, Captain of Tempest* *Aug '20 – Nov '21*
  - **Axolotl**: Designed the 250 lb. $15k Axolotl using Fusion360. Competed in **S5 of Discovery Channel's BattleBots**
- **VEX Robotics** — *Captain of 5956F Bangarang* *Aug '19 – Jun '21*
  - **VRC World Skills Challenge**: Designed a robot that ranked 7th place of 20k+ competitors in the 2019 – 2020 season
  - **Metalwork**: Turned & tapped 116 Grade 5 Titanium standoffs with manual lathe, used in the 2020 – 2021 season

Honors & Awards

- WPI **$4.5k Stipend** research in legged robot acrobatics, demonstrated quadruped backflip in simulation (Jun. 2023)
- Goathacks **Honorable Mention** for developing Gakkou ni Gonpei, a Subway Surfers style game based on WPI's mascot, using Unity and C# (Jan. 2023)
- Orange County Science & Engineering Fair **Honorable Mention** for smoke detector radiation research; built a cloud chamber and visualized the beta particles emitted in American homes (Feb. 2017)
- Duke Academic **Talent Search winner**, selected for a 3-week residential program at Rollins College (Apr. 2017)

Community Impact

- **Acquired an $18k Asset for Robotics Education** — WPI, Massachusetts
  *Negotiated a **Unitree Go1 down to $5k**, allowing students to experiment with real hardware* — *Aug '22 – Dec '23*
- **HERO Volunteer** — WPI, Massachusetts
  ***Volunteered 1,120 hours** helping the Horizon Exploratory RObotics research group at WPI* — *Dec '22 – Jul '23*
- **Helping the Homeless** — Orlando, Florida
  *Made **hundreds of sleeping bags** for homeless people out of recycled plastic (plarn)* — *Aug '20 – May '21*
- **DJ at Arbor School of Central Florida** — Oveido, Florida
  Delivered performances as a DJ at events such as prom for students with disabilities — *Aug '17 – Apr '19*
- **Event Volunteer at Down Syndrome Association of Central Florida** — Orlando, Florida
  *Volunteered annually in the **Step Up For Down Syndrome** event, caring for disabled brother* — *Oct '09 – Oct '19*