James Zhu

jameszhu@andrew.cmu.edu • jameswzhu.github.io

Education

Carnegie Mellon University
PhD in Mechanical Engineering *Spring 2025*
3.89/4.00 GPA

Carnegie Mellon University
Master of Science in Mechanical Engineering *December 2022*
3.89/4.00 GPA

Vanderbilt University
Bachelor of Engineering in Mechanical Engineering and Mathematics – Cum Laude *May 2020*
3.79/4.00 GPA

Experience

Robomechanics Lab at CMU **Pittsburgh, PA**
Graduate Research Assistant *May 2020 – Current*
Advisor: Aaron Johnson

Medical Engineering and Discovery Lab at Vanderbilt **Nashville,TN**
Undergraduate Research Assistant *August 2018 – May 2020*
Advisor: Robert Webster

Jet Propulsion Laboratory **Pasadena, CA**
High Contrast Imaging Intern *May 2019 – July 2019*
Supervisor: Stuart Shaklan

Robotics and Autonomous Systems Lab at Vanderbilt **Nashville,TN**
Undergraduate Research Assistant *September 2017 – May 2018*
Advisor: Nilanjan Sarkar

Current and Recent Projects

Control Theory for Legged Robots

Convergent iLQR for Safe Trajectory Planning and Control of Legged Robots
IEEE Conference on Decision and Control (CDC) *December 2023*

- Developed trajectory optimization algorithm that leverages nonlinearities in smooth and hybrid dynamics to plan trajectories that improve tacking performance and robustness while requiring less actuator effort to track
- Demonstrated efficacy of algorithm on monoped hopper and quadruped robot models

Hybrid Event Shaping to Stabilize Periodic Hybrid Orbits
IEEE International Conference on Robotics and Automation (ICRA) *May 2022*

- Proposed novel framework to optimize stability of open-loop walking gaits using saltation matrix in Floquet analysis
- Unified previous works of stable paddle juggling and swing-leg retraction and extended to complex bipedal walker system

Robot Ethics

Grounding Robot Navigation in Self-Defense Law
IEEE Conference on Robot and Human Interactive Communication (RO-MAN) *August 2023*

- Examined how self-defense law can inform robot developers on the current drawbacks of human-aware path planning algorithms
- Made four actionable recommendations to roboticists in industry, academia, and professional associations to design robots around mitigating the likelihood of self-defense scenarios arising

By Air or by Land: How Locomotion Methods Dictate Drone Ethics
ICRA Workshop on Ethics and Lethal Autonomous Weapons Systems *May 2022*

- Considered ethical implications of teleoperated weaponized ground robots in comparison to aerial counterparts
- Discussed a robot's ability/inability to quickly comprehend and act upon noisy data gathered in a complicated human environment

Publications

Convergent iLQR for Safe Trajectory Planning and Control of Legged Robots
James Zhu, *J Joe Payne, and Aaron M Johnson*
2023 IEEE Conference on Decision and Control

Grounding Robot Navigation in Self-Defense Law
James Zhu, *Anoushka Shrivastava, and Aaron M Johnson*
2023 IEEE International Conference on Robot and Human Interactive Communication

By Air or by Land: How Locomotion Methods Dictate Drone Ethics
James Zhu *and Aaron M Johnson*
2022 ICRA Workshop on Addressing Ethical and Technical Challenges in the Development, Use and Governance of Lethal Autonomous Weapons Systems

Hybrid Event Shaping to Stabilize Periodic Hybrid Orbits
James Zhu, *Nathan J Kong, George Council, and Aaron M Johnson*
2022 IEEE International Conference on Robotics and Automation

Design and System Validation of Rassle: A Novel Active Social Assistive Robot with a User Interface for Elderly with Dementia
Zhaobo K Zheng, ***James Zhu***, *Jing Fan, and Nilanjan Sarkar*
2018 IEEE International Symposium on Robot and Human Interactive Communication

Additional Presentations and Conferences

CMU MechE PhD Symposium
Presented poster, "Convergent Planning and Control of Legged Robots" *March 2023*

WeRobot
Attended conference to discuss policy recommendations for ethical use of robots *September 2022*

Robotics: Science and Systems (RSS) Risk Aware Decision Making Workshop
Gave lightning talk "Convergent iLQR for Underactuated Hybrid Dynamical Systems" *June 2022*

Carnegie Mellon Locomotion Seminar
Gave talk, "Hybrid Event Shaping to Generate Stable Robotic Gaits" *March 2022*

Teaching

Advisory Board Member: CMU Teaching & Learning Summit *September 2023*
Inclusive STEM Teaching Certificate *April 2023*
Teaching Assistant: Dynamics *Spring 2022 and Spring 2023*
Graduate Teaching Fellow: CMU Eberly Center *Fall 2022 – Present*
Teaching Assistant: Intro to Robotics *Spring 2019*
Teaching Assistant: Probability and Statistical Inference *Spring 2019*

Leadership and Honors

Equity Researcher: Equitable and Just Greater Pittsburgh *December 2022 – Present*
Tech Stewardship Practice Program Certificate *December 2022*
Organizer: Robotics Outreach for Gwen's Girls after-school program *Fall 2020 – Present*
Featured in CMU Engineering Magazine article
Carolyn Commer Graduate Student Involvement Award *May 2021*

Co-chair: Mechanical Engineering DEI Outreach Subcommittee *January 2021 – May 2022*
Student Mentor: Carnegie Mellon Tartan Scholars Program *August 2020 – May 2021*
Schiff Family Scholarship *2018–2020*

Memberships

IEEE Control Systems Society *2023 - Present*
ASME Graduate Student Member *2022 - Present*
IEEE Robotics and Automation Society *2022 - Present*
IEEE Student Member *2022 - Present*