

# James Zhu

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## Education

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### Carnegie Mellon University

*PhD in Mechanical Engineering*

*September 2024*

Thesis: Navigating a Complex World: Improving Robot Outcomes Through Social, Regulatory, and Control Theoretic Approaches

### Carnegie Mellon University

*Master of Science in Mechanical Engineering*

*December 2022*

### Vanderbilt University

*Bachelor of Engineering in Mechanical Engineering and Mathematics*

*May 2020*

Cum Laude

## Experience

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### Robomechanics Lab at CMU

*Graduate Research Assistant*

Advisor: Aaron Johnson

**Pittsburgh, PA**

*May 2020 – September 2024*

### The AI Institute

*Robots, Ethics, & Society Research Intern*

Supervisor: Kate Darling

**Boston, MA**

*January 2024 – June 2024*

### Medical Engineering and Discovery Lab at Vanderbilt

*Undergraduate Research Assistant*

Advisor: Robert Webster

**Nashville, TN**

*August 2018 – May 2020*

### Jet Propulsion Laboratory

*High Contrast Imaging Intern*

Supervisor: Stuart Shaklan

**Pasadena, CA**

*May 2019 – July 2019*

### Robotics and Autonomous Systems Lab at Vanderbilt

*Undergraduate Research Assistant*

Advisor: Nilanjan Sarkar

**Nashville, TN**

*September 2017 – May 2018*

## Teaching

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Teaching Consultant Fellow: CMU Eberly Center

*September 2022 – December 2023*

Advisory Board Member: CMU Teaching & Learning Summit

*September 2023*

Inclusive STEM Teaching Certificate

*April 2023*

Teaching Assistant: Dynamics

*Spring 2022 and Spring 2023*

Teaching Assistant: Intro to Robotics

*Spring 2019*

Teaching Assistant: Probability and Statistical Inference

*Spring 2019*

## Leadership and Honors

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Co-Founder: Cup of Wontons

*February 2023 – December 2023*

Equity Researcher: Equitable and Just Greater Pittsburgh

*December 2022 – December 2023*

Tech Stewardship Practice Program Certificate

*December 2022*

Organizer: Robotics Outreach for Gwen's Girls after-school program

*Fall 2020 – Fall 2022*

Featured in CMU Engineering Magazine article

Co-chair: Mechanical Engineering DEI Outreach Subcommittee

*January 2021 – May 2022*

Carolyn Commer Graduate Student Involvement Award

*May 2021*

Student Mentor: Carnegie Mellon Tartan Scholars Program

*August 2020 – May 2021*

Schiff Family Scholarship

*2018–2020*

## Publications

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### Journal Papers

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#### **The Effect of Gait Parameters on Safe Quadrupedal Robot Locomotion**

**James Zhu**, Selvin Garcia Gonzalez, David Ologan, Ardalan Tajbakhsh, and Aaron M Johnson

In Preparation: IEEE Robotics and Automation Letters

#### **Scalable and Safe Motion Planning in Presence of Uncertain Multi-Modal Agents**

Ardalan Tajbakhsh, Siddarth Nair, David Ologan, Amey Shah, **James Zhu**, Lorenz T Biegler, and Aaron M Johnson

In Preparation: IEEE Robotics and Automation Letters

#### **Saltation Matrices: The Essential Tool for Linearizing Hybrid Dynamical Systems**

Nathan J Kong, J Joe Payne, **James Zhu**, and Aaron M Johnson

2024 Proceedings of the IEEE

### Conference Papers

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#### **h-iLQE: Optimal State Estimation for Hybrid Systems**

J Joe Payne, **James Zhu**, Nathan J Kong, and Aaron M Johnson

In Preparation: 2025 IEEE International Conference on Robotics and Automation

#### **Safe Kinodynamic RRT\* for Navigating Friction Transitions**

Joshua Ramos, **James Zhu**, Paul Nadan, and Aaron M Johnson

In Preparation: 2025 IEEE International Conference on Robotics and Automation

#### **Improving Equity in Robot Deployment: A Study of Food Pantry Patrons**

**James Zhu**, Pedro Reynolds-Cuellar, Nozomi Nakajima, Arihant Yadav, Eakta Jain, Aaron M Johnson, and Kate Darling

In Preparation: 2025 ACM/IEEE International Conference on Human-Robot Interaction

#### **Robot Behaviors Inspired by Human-Horse Interaction: A User Study**

Arihant Yadav, Pedro Reynolds-Cuellar, Nozomi Nakajima, **James Zhu**, Eakta Jain, and Kate Darling

In Preparation: 2025 ACM/IEEE International Conference on Human-Robot Interaction

#### **Convergent iLQR for Safe Trajectory Planning and Control of Legged Robots**

**James Zhu**, J Joe Payne, and Aaron M Johnson

2024 IEEE International Conference on Robotics and Automation

#### **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

#### **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 Rassel: 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

### Other Papers

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#### **Double-Anonymous Review for Robotics**

Justin K Yim, Paul Nadan, **James Zhu**, Alexandra Stutt, J Joe Payne, Catherine Pavlov, Aaron M Johnson

2022 Technical Report: arXiv:2406.10059

#### **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

### Presentations

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#### **Designing Safe Quadrupedal Gaits**

ICRA Advancements in Trajectory Optimization and MPC for Legged Systems Workshop

Poster

May 2024

#### **Navigating a Complex World: How to Bring Robots Into the Wild**

NYU Dynamical Systems Lab Seminar

Invited Talk

April 2024

## **An Engineering Perspective on Legislation Challenges for Autonomous Delivery Robots**

*Georgia Tech Solving for X Workshop*

*February 2024*

Session Organizer

## **Grounding Robot Navigation in Self-Defense Law**

*WeRobot*

*October 2023*

Poster

## **Convergent Planning and Control of Legged Robots**

*IEEE RAS TC on Model-Based Optimization for Robotics Poster Session*

*July 2023*

Poster

## **Convergent Planning and Control of Legged Robots**

*CMU MechE PhD Symposium*

*March 2023*

Poster

## **Convergent iLQR for Underactuated Hybrid Dynamical Systems**

*RSS Risk Aware Decision Making Workshop*

*June 2022*

Lightning Talk

## **Hybrid Event Shaping to Generate Stable Robotic Gaits**

*Carnegie Mellon Locomotion Seminar*

*March 2022*

Invited Talk

## **Additional Conferences**

Ethical and Legal Dilemmas of Autonomous Weapons in War and National Security Conference

*April 2024*

Invited Participant

WeRobot

*September 2022*

Participant

## **Students Mentored**

Joshua Ramos

*February 2022 - September 2024*

BS in Electrical Engineering, CMU

Selvin Garcia Gonzalez

*February 2024 - July 2024*

MS in Mechanical Engineering, CMU

Karla Soto Cuevas

*September 2023 - December 2023*

MS in Mechanical Engineering, CMU

Sasha Kroman

*September 2023 - December 2023*

BS in Mechanical Engineering, CMU

Nikhil Chinnalapatti Gopinath

*June 2023 - December 2023*

MS in Mechanical Engineering, CMU

Anoushka Srivastava

*January 2023 - May 2023*

BS in Artificial Intelligence, CMU