

# Maegan Tucker

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## APPOINTMENTS

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### Georgia Institute of Technology

ASSISTANT PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING AND MECHANICAL ENGINEERING 2023-Present

## EDUCATION

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### California Institute of Technology

PH.D. IN MECHANICAL ENGINEERING 2017-2023

- Academic Advisor: Dr. Aaron D. Ames
- Dissertation: [“Enabling Robust and User-Customized Bipedal Locomotion on Lower-Body Assistive Devices via Hybrid System Theory and Preference-Based Learning”](#)

M.S. IN MECHANICAL ENGINEERING 2017-2019

- Overall GPA: 4.0/4.0

### Georgia Institute of Technology

B.S. IN MECHANICAL ENGINEERING 2012-2017

- Overall GPA: 3.8/4.0, Major GPA: 3.88/4.0

## RESEARCH

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### Research Interests

- Robotic assistive devices, bipedal robotic locomotion, human-robot interaction, preference-based learning

### Publications

- [A.1] **Tucker, M.**, Li, K., and Ames, A. D. “Synthesizing Robust Walking Gaits via Discrete-Time Barrier Functions with Application to Multi-Contact Exoskeleton Locomotion.” *IEEE International Conference on Robotics and Automation (ICRA)*, 2024. [\[Preprint\]](#)
- [A.2] Ingraham, K.\* A., **Tucker, M.\***, Ames, A. D., Rouse, E. J., and Shepherd, M. K. “Leveraging User Preference in the Design and Evaluation of Lower-Limb Exoskeletons and Prostheses.” *Current Opinion in Biomedical Engineering*, 2023. (\*Denotes equal contribution) [\[Paper\]](#)
- [A.3] Ghansah, A., Kim, J., **Tucker, M.**, and Ames, A. D. “Humanoid Robot Co-Design: Coupling Hardware Design with Gait Generation via Hybrid Zero Dynamics.” *IEEE Conference on Decision and Control (CDC)*, 2023. [\[Preprint\]](#)
- [A.4] Culbertson, P., Cosner, R., **Tucker, M.**, and Ames, A. D. “Input-to-State Stability in Probability.” *IEEE Conference on Decision and Control (CDC)*, 2023. [\[Preprint\]](#)
- [A.5] **Tucker, M.**, and Ames, A. D. “An input-to-state stability perspective on robust locomotion.” *IEEE Control Systems Letters*. 2023. [\[Preprint\]](#)
- [A.6] Gehlhar, R., **Tucker, M.**, et al. “A Review of Current State-of-the-Art Control Methods for Lower-Limb Powered Prostheses.” *Annual Reviews in Control*. 2023. [\[Paper\]](#)
- [A.7] **Tucker, M.**, Csomay-Shanklin, N., and Ames, A. D. “Robust Bipedal Locomotion: Leveraging Saltation Matrices for Gait Optimization.” *IEEE International Conference on Robotics and Automation (ICRA)*, 2023. [\[Preprint\]](#)
- [A.8] Cosner, R., **Tucker, M.**, et al. “Safety-Aware Preference-Based Learning for Safety-Critical Control.” *Learning for Dynamics and Control Conference*. PMLR, 2022. [\[Paper\]](#)
- [A.9] Li, K., **Tucker, M.**, et al. “Natural Multicontact Walking for Robotic Assistive Devices via Musculoskeletal Models and Hybrid Zero Dynamics.” *IEEE Robotics and Automation Letters (RA-L)*, 7(2), pp. 4283-4290. 2022. [\[Preprint\]](#)
- [A.10] Csomay-Shanklin, N., **Tucker, M.**, et al. “Learning Controller Gains on Bipedal Walking Robots via User Preferences.” In *2022 IEEE International Conference on Robotics and Automation (ICRA)*, 2022. [\[Preprint\]](#)

- [A.11] Kerdraon, J., Previnaire, J.G., **Tucker, M.**, et al. "Evaluation of safety and performance of the self balancing walking system Atalante in patients with complete motor spinal cord injury." *Spinal cord series and cases* 7.1 (2021): 1-8. [[Shareable Link](#)]
- [A.12] **Tucker, M.**, Csomay-Shanklin, N., Ma, W., & Ames, A. D. "Preference-based learning for user-guided hzd gait generation on bipedal walking robots." In *2021 IEEE International Conference on Robotics and Automation (ICRA)*, 2021. [[Preprint](#)]
- [A.13] Li, K., **Tucker, M.**, et al. "ROIAL: Region of Interest Active Learning for Characterizing Exoskeleton Gait Preference Landscapes." In *2021 IEEE International Conference on Robotics and Automation (ICRA)*, 2021. [[Preprint](#)]
- [A.14] **Tucker, M.**, et al. "Human Preference-Based Learning for High-dimensional Optimization of Exoskeleton Walking Gaits." In *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 3423-3430. 2020. [[Paper](#)]
- [A.15] **Tucker, M.\***, Novoseller, E.\*, et al. "Preference-Based Learning for Exoskeleton Gait Optimization." In *2020 IEEE International Conference on Robotics and Automation (ICRA)*, 2020. (\*Denotes equal contribution) [[Paper](#)]
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| Best Overall Paper Award (of 3,512 submissions) at ICRA 2020.<br>Best Paper in Human-Robot Interaction Award at ICRA 2020. |
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- [A.16] Gurriet, T., **Tucker, M.**, Duburcq, A., Boeris, G., & Ames, A. D. "Towards Variable Assistance for Lower Body Exoskeletons." *IEEE Robotics and Automation Letters*, 5(1), pp. 266-273. 2019. [[Paper](#)]

### Posters

- [B.1] "Accounting for User Comfort In Exoskeleton Locomotion via Preference-Based Learning". at the *Online machine learning-based control of lower-limb exoskeletons* workshop of ICRA 2022.
- [B.2] "Preference-Based Learning for Dynamic Bipedal Locomotion." at Dynamic Walking 2021. [Abstract](#), [Poster](#)
- [B.3] "Evaluating the Mechanical Design of a Transfemoral Powered Prosthesis through Metabolic Cost." at the Georgia Tech S.U.R.E. Symposium, 2016. [Poster](#)

### Patents

- [C.1] Provisional patent (full patent in progress): A Front-Leg Assistive Exoskeleton (CIT 8777-P)
- [C.2] Filed Patent: Real-Time Feedback Module For Assistive Gait Training, Improved Proprioception, And Fall Prevention (US20210027877A1)

### Presentations

- [D.1] Accounting for User Comfort In Exoskeleton Locomotion via Preference-Based Learning  
Online machine learning-based control of lower-limb exoskeletons workshop, May 2022 (ICRA).
- [D.2] Preference-Based Learning and Control: Realizing Dynamic Locomotion on Bipedal Robots and Exoskeletons  
39th Southern California Control Workshop, April 2022.
- [D.3] Stable and Robust Bipedal Locomotion for Lower-Body Assistive Devices  
University of Illinois at Urbana-Champaign (UIUC), December 2021.
- [D.4] Preference-Based Learning for Exoskeleton Gait Optimization  
Wandercraft Webinar, Paris (virtually), November 2021.
- [D.5] Enabling Bipedal Locomotion with Robotic Assistive Devices through Learning and Control  
Decision and Control Laboratory Seminar, Georgia Tech, October 2021.
- [D.6] Research in Lower-Body Exoskeleton Technology  
Hanger Clinic (virtually), September 2021
- [D.7] Preference-Based Learning for User-Guided HZD Gait Generation on Bipedal Walking Robots  
ICRA, May 2021

- [D.8] Human Preference-Based Learning for High-Dimensional Optimization of Exoskeleton Walking Gaits  
IROS, October 2020
- [D.9] Whats Next in Motion? From Robot Sherpas to Exoskeletons  
DFCon, October 2020
- [D.10] Lower-Body Exoskeleton Locomotion  
Yue Lab Group Meeting Presentation, August 2020
- [D.11] Human Preference-Based Learning for Optimization of Exoskeleton Walking Gaits  
GoogleX (virtually), April 2020.
- [D.12] Preference-Based Learning for Exoskeleton Gait Optimization  
ICRA, May 2020
- [D.13] Haptic Cane Module  
Rancho Los Amigos National Rehabilitation Center, January 2020

## HONORS AND AWARDS

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- **2023 Centennial Prize for Best Thesis in Mechanical and Civil Engineering:** Awarded annually to a Caltech Ph.D. candidate in applied mechanics, civil engineering, or mechanical engineering, whose doctoral thesis is judged to be the most original and significant by a faculty committee.
- **2021-2022 Simoudis Discovery Prize:** Awarded to a Caltech student or postdoc conducting emerging research at the intersection of big data, machine learning, and autonomy. The recipient selected by a committee of faculty from the Department of Computer and Mathematical Sciences.
- **2020 ICRA Best Paper Awards:** Awarded both the Best Conference Paper Award and the Best Paper Award on Human-Robot Interaction at ICRA 2020.
- **2020 ME Rising Star:** Participated in the ME Rising Stars Workshop (hosted by Berkeley), 2020.
- **NSF Graduate Research Fellowship Program:** Awarded 2019
- **NSF Graduate Research Fellowship Program:** Honorable Mention 2017
- **Presidents Undergraduate Research Salary Award (Spring 2017):** \$1500 student research stipend
- **First Place for Overall Presentation:** Awarded based on poster and oral presentation among 40 students in Georgia Techs S.U.R.E. REU program (Summer 2016).

## FUNDING AND GRANTS

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- Simoudis Discovery Prize: \$10,000 discretionary money awarded to one Caltech graduate student per year.
- NSF Graduate Research Fellowship (Awarded 2019): one of 2,000 awarded of 13,000 applicants. Fellowship consists of three-year annual stipend of \$34,000 along with a \$12,000 cost of education allowance for tuition and fees (paid to the institution)
- Caltech Mechanical and Civil Engineering Department *Big Ideas Fund*: One year grant for research focused on developing a soft ankle exoskeleton
- Theodore Y. Wu Graduate Fellowship: Graduate Tuition and Stipend for the 2017 Academic year.
- Presidents Undergraduate Research Salary (PURA) Award: \$1500 undergraduate research stipend awarded for the Spring 2017 academic semester.

## TEACHING EXPERIENCES AND WORKSHOPS

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- Caltech Rise Program Workshop: Creating Math Skills Worksheets (January 29, 2020)
- STEMulate Learning Workshop: Closing the Gaps in Mathematics (October 6, 2020)
- Teaching Assistant for Caltech course “CDS 131: Linear Systems Theory” (Fall 2018)
- Shell Tutor for Georgia Tech course “COE 3001: Mechanics of Deformable Bodies” (Fall 2016)

## UNDERGRADUATE ADVISING

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- [Neil Janwani](#) (Caltech 2021-2024 — awarded NSF GFRP 2024)
- Sara Frunzi (Caltech 2023 — now a PhD student at Drexel University)
- Yash Mhaskar (Caltech 2022 — now a PhD student at Georgia Tech, awarded NSF GFRP 2024)
- [Lorenzo Shaikewitz](#) (Caltech 2020-2022 – now a PhD student at MIT, awarded NSF GFRP 2023)
- Ozioma Ozor-Ilo (Caltech 2021 — now a PhD student at MIT)
- Toussaint Pegues (Caltech 2020-2021 — now at Whirlpool Corporation)
- [Myra Cheng](#) (Caltech 2019-2020 — now a PhD student at Stanford, awarded NSF GFRP 2022)
- [Sofia Kwok](#) (Caltech 2019 — now a PhD student at Carnegie Mellon)
- Paulina Ridland (Caltech 2019 — now at AeroVironment)
- [Allie Cheng](#) (Caltech 2019 — now at Boston Dynamics)
- Diana Frias Franco (Caltech 2019 — now a PhD student at Carnegie Mellon)
- Annabel Gomez (Caltech 2019 — now at JPL)

## MEDIA MENTIONS

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### Personal:

- Georgia Tech Story, Accessed Oct 19 2023: [link](#)
- Caltech Graduate Admissions Page, “Meet our Students!”, Accessed July 4 2021: [link](#)
- The Caltech Breakthrough Campaign, “The Math of Human + Machine”, Nov 18 2019: [link](#)
- Women Doing Science, Oct 14 2019: [Facebook link](#) [Instagram Link](#)

### Research:

- CNBC, “How robots are replacing wheelchairs to help people with disabilities walk again”, May 30 2020: [link](#)
- IEEE Spectrum, “Caltechs Brain-Controlled Exoskeleton Will Help Paraplegics Walk”, Jan 6 2020: [link](#)

## INDUSTRY EXPERIENCE

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MECHANICAL ENGINEERING CO-OP AT NCR CORPORATION (Fall 2014, Summer 2015, Spring 2016)

- Completed 3 full-time semester rotations working closely with a 5-person hardware engineering team.
- Contributed to the design, testing, manufacturing and release of 3 new Point of Sale (POS) terminals.

## DEI EFFORTS

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- Engineering and Applied Sciences (EAS) Graduate Student Council (GSC) Member: Division-wide student council comprised of 2-3 peer-nominated student leaders from each EAS department. The council meets once per quarter and is tasked with providing a communication channel from the student body to the EAS leadership. (2021-2023)
- FUTURE Ignited: One of six graduate students selected to participate in the Future Ignited event for the Caltech Mechanical and Civil Engineering (MCE) department. The event was a online/virtual conference for underrepresented students, aimed at providing insight into the life of a graduate student.
- Sustainable Strategy for Enhancing Existing Diversity (SEED) Committee Member: One of five members assigned to construct an actionable long-term plan for enhancing and supporting diversity with the Mechanical and Civil Engineering Department of Caltech. The proposed plan is published in our [\[Report\]](#).
- Outreach Chair for Caltech Department of Mechanical and Civil Engineering (2020-2023)
- Freshman Summer Research Institute (FSRI): Constructed and led a 5-week research project for two incoming undergraduate student women interested in controls/robotics. (Summer 2019)
- Caltech Rise Tutor: Weekly (for two hours each week) volunteer for the Rise Program, an afterschool math and science-focused tutoring program serving public schools students. (2017-2021)