Maegan Tucker

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APPOINTMENTS

Incoming Assistant Professor (starting January 2024) at the Georgia Institute of Technology in the School of Electrical and Computer Engineering as well as the Georgia W. Woodruff School of Mechanical Engineering.

EDUCATION

California Institute of Technology

PH.D. IN MECHANICAL ENGINEERING   2017-2023(anticipated)
- Academic Advisor: Dr. Aaron D. Ames

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

Research Interests

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

Publications

[A.1] 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.2] **Tucker, M.**, Csomay-Shanklin, N., and Ames, A. D. "Robust Bipedal Locomotion: Leveraging Saltation Matrices for Gait Optimization." *To appear at ICRA,* 2023. [Preprint]

[A.3] 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.4] 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.5] 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.6] 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.7] **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.8] 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.9] **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.10] **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]

> Best Overall Paper Award (of 3,512 submissions) at ICRA 2020.
> Best Paper in Human-Robot Interaction Award at ICRA 2020.

[A.11] 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]

Working Papers

[B.1] Ghansah, A., Kim, J., **Tucker, M.**, and Ames, A. D. "Humanoid Robot Co-Design: Coupling Hardware Design with Gait Generation via Hybrid Zero Dynamics." *In Review,* 2023.

[B.2] Culbertson, P., Cosner, R., **Tucker, M.**, and Ames, A. D. "Input-to-State Stability in Probability." *In Review,* 2023.

[B.3] **Tucker, M.**, and Ames, A. D. "An Input-to-State Stability Perspective on Robust Locomotion." *In Review,* 2023. [Preprint]

[B.4] **Tucker, M.**, et al. "Learning User-Preferred Exoskeleton Walking for People with Complete Paraplegia." *In Review* 2022.

[B.5] **Tucker, M.**, et al. "POLAR: Preference Optimization and Learning Algorithms for Robotics." [Preprint]

[B.6] **Tucker, M.**, et al. "Preference-Based Learning for Optimizing Robotic Behaviors."

Posters

[C.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.

[C.2] "Preference-Based Learning for Dynamic Bipedal Locomotion." at Dynamic Walking 2021. Abstract, Poster

[C.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

[D.1] Provisional patient (full patent in progress): A Front-Leg Assistive Exoskeleton (CIT 8777-P)

[D.2] Filed Patent: Real-Time Feedback Module For Assistive Gait Training, Improved Proprioception, And Fall Prevention (US20210027877A1)

Presentations

[E.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).

[E.2] Preference-Based Learning and Control: Realizing Dynamic Locomotion on Bipedal Robots and Exoskeletons
39th Southern California Control Workshop, April 2022.

[E.3] Stable and Robust Bipedal Locomotion for Lower-Body Assistive Devices
University of Illinois at Urbana-Champaign (UIUC), December 2021.

[E.4] Preference-Based Learning for Exoskeleton Gait Optimization
Wandercraft Webinar, Paris (virtually), November 2021.

[E.5] Enabling Bipedal Locomotion with Robotic Assistive Devices through Learning and Control
Decision and Control Laboratory Seminar, Georgia Tech, October 2021.

[E.6] Research in Lower-Body Exoskeleton Technology
Hanger Clinic (virtually), September 2021

[E.7] Preference-Based Learning for User-Guided HZD Gait Generation on Bipedal Walking Robots
ICRA, May 2021

[E.8] Human Preference-Based Learning for High-Dimensional Optimization of Exoskeleton Walking Gaits
IROS, October 2020

[E.9] Whats Next in Motion? From Robot Sherpas to Exoskeletons
  DFCon, October 2020

[E.10] Lower-Body Exoskeleton Locomotion
  Yue Lab Group Meeting Presentation, August 2020

[E.11] Human Preference-Based Learning for Optimization of Exoskeleton Walking Gaits
  GoogleX (virtually), April 2020.

[E.12] Preference-Based Learning for Exoskeleton Gait Optimization
  ICRA, May 2020

[E.13] Haptic Cane Module
  Rancho Los Amigos National Rehabilitation Center, January 2020

FUNDING AND GRANTS

- 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

- 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)

ACADEMIC WORKSHOPS

- ME Rising Stars Workshop (hosted by Berkeley), October 2, 2020

UNDERGRADUATE ADVISING

- Ozioma Ozor-Ilo (WAVE student, Summer 2021)

- Neil Janwani (SURF student, Summer 2021)

- Toussaint Pegues (SURF student, Summer 2020 and 2021)

- Lorenzo Shaikewitz (SURF student, Summer 2020)

- Myra Cheng (Fall 2019 and Winter 2020)

- Sofia Kwok (SURF student, Summer 2019)

- Paulina Ridland (SURF student, Summer 2019)

- Allison Cheng (SURF student, Summer 2019)

- Diana Frias Franco (FSRI student, Summer 2019)

- Annabel Gomez (Caltech Freshman Summer Research Institute (FSRI) student, Summer 2019)

- Jesus Hernandez (Caltech Summer Undergraduate Research Fellowship (SURF) student, Summer 2018)

MEDIA MENTIONS

Personal:

- 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

HONORS AND AWARDS

- **Recipient of 2021-2022 Simoudis Discovery Prize:** This prize is 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.

- **Best Paper Awards (ICRA 2020):** Awarded both the Best Conference Paper Award and the Best Paper Award on Human-Robot Interaction at ICRA 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).

INDUSTRY EXPERIENCE

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

- 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-Current)

- 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-Current)

- 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)

COMMUNITY OUTREACH

- Visiting speaker for the Hanger Clinic: Presented and discussed my research involving lower-body exoskeletons for the Hanger Amputee Support Group. (September 28, 2021)

- Muir High School Engineering Week Panelist: Presented my research journey to a group of 12 high-school students pursuing careers in STEM, followed by a 30 minute Q&A session. (February 17, 2021)

SKILLS

- Programming Languages: MATLAB, Simulink, C++, Python, Bash, HTML, Markdown

- Modeling Software: Solidworks, AutoCad, Inventor, ProEngineer (Creo)

- Graphical Software: Inkscape, Adobe After Effects, Adobe Premier

- Machining: Certified to operate the Caltech and Georgia Tech Machine Shops (CNC Milling, Lathe, Waterjet, Vertical Band Saw, etc.)

- Languages: Native - English, Proficient - French