

# Mike Hagenow

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## Research Interests

### Human-Robot Physical Interaction Modeling and Shared Control/Autonomy

Research focuses on answering how shared control and shared autonomy in robotics can assist skilled workers in completing complex and injury-prone tasks. Broad research interests include controls, applications of learning models (e.g., DMPs, HMMs) in human-robot interaction models, and dynamics of physical interaction. Informally co-advised by Michael Zinn, Michael Gleicher, and Bilge Mutlu (NASA ULI).

## Education

### University of Wisconsin - Madison | PhD in Mechanical Engineering In Progress | Madison, WI

- Minor: Computer Science • Advisor: Michael Zinn, Ph.D. • 4.0/4.0

### University of Wisconsin - Madison | MS in Mechanical Engineering Dec 2019 | Madison, WI

- Phi Kappa Phi • 4.0/4.0

### Tufts University | BS in Mechanical Engineering May 2014 | Medford, MA

- Tau Beta Pi • Dean's List (7/7 eligible semesters)

## Experience

### UW-Madison | Graduate Research Assistant 2019 – Present | Madison, WI

- NSF grant exploring communication in human-robot interaction.
- NASA University Leadership Initiative focused on aircraft manufacturing and development of shared robotic assistants for physically demanding and challenging tasks.

### NASA - Johnson Space Center | Intern - ER4 2021 | Houston, TX

- Supervisor: Dr. Kimberly Hambuchen, Mentor: Evan Laske
- Investigating human-in-the-loop corrective methods for semi-automated fitting of affordance templates/primitives for use in remote robot programming during intra-vehicular activities (IVAs).

### Epic Systems | Manager - MyChart - Technical Services 2014 – 2017 | Verona, WI

- Managed 5-6 direct reports. Development and planning lead for Clinical Data for MyChart. Responsible for technical support for several large hospital contracts. VB development of internal tools for accounting.

## Publications

Up-to-date publications on [Google Scholar](#)

## Under Review

- R2. Senft, E.<sup>†</sup>, **Hagenow, M.<sup>†</sup>**, Praveena, P., Radwin, R., Zinn M., Gleicher, M., and Mutlu, B. "A Method For Automated Drone Viewpoints to Support Remote Robot Manipulation," 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Submitted.
- R1. **Hagenow, M.**, Senft, E., Laske, E., Hambuchen, K., Fong, T., Radwin, R., Gleicher, M., Mutlu, B. and Zinn, M. "Registering Articulated Objects With Human-in-the-loop Corrections," IEEE Robotics and Automation Letters, Submitted.

## Journal Articles

- **J3.** Senft, E., **Hagenow, M.**, Welsh, K., Radwin, R., Zinn, M., Gleicher, M., and Mutlu, B. (2021) "Task-Level Authoring for Remote Robot Teleoperation," *Front. Robotics, AJ* 8:707149.
- **J2. Hagenow, M.**, Senft, E., Radwin, R., Gleicher, M., Mutlu, B. and Zinn, M. "Informing Real-time Corrections in Corrective Shared Autonomy Through Expert Demonstrations," *IEEE Robotics and Automation Letters*, vol. 6, no. 4, pp. 6442-6449, Oct. 2021.
- **J1. Hagenow, M.**, Senft, E., Radwin, R., Gleicher, M., Mutlu, B. and Zinn, M. "Corrective Shared Autonomy for Addressing Task Variability," *IEEE Robotics and Automation Letters*, vol. 6, no. 2, pp. 3720-3727, April 2021.

## Refereed Conference Papers

- **C4.** Zhang, B., **Hagenow, M.**, Mutlu, B., Gleicher, M., and Zinn, M. "Assessing the Perceived Realism of Kinesthetic Haptic Renderings Under Parameter Variations" 2022 IEEE Haptics Symposium (HAPTICS). IEEE, Accepted for Publication.
- **C3.** Senft, E., **Hagenow, M.**, Radwin, R., Zinn M., Gleicher, M., and Mutlu, B. "Situated Live Programming for Human-Robot Collaboration," The 34th Annual ACM Symposium on User Interface Software and Technology. 2021.
- **C2. Hagenow, M.**, Zhang, B., Mutlu, B., Zinn, M., and Gleicher, M. "Recognizing Orientation Slip in Human Demonstrations," 2021 International Conference on Robotics and Automation (ICRA), 2021.
- **C1.** W. Hu, Q. Fan, A. H. Nicholas, **M. C. Hagenow**, and A. T. Ohta. "Bubble micro-manipulator for co-operative micro-manipulation," 9th IEEE International Conference on Nano/Micro Engineered and Molecular Systems (IEEE-NEMS), Honolulu, HI, Apr. 2014.

## Refereed Workshop Papers

- **W4.** Doshi, M., Zhang, B., **Hagenow, M.**, Gleicher, M., Mutlu, B., Radwin, R., and Zinn, M. "Bidirectional 1-DOF Handheld Haptic Device for Precise Differential Process Control," Mentoring Forum at 2022 IEEE Haptics Symposium, 2022.
- **W3.** Zhang, B., **Hagenow, M.**, Mutlu, B., Gleicher, M., and Zinn, M. "Effect-Adjective Associations of Kinesthetic-Based Haptic Renderings," Mentoring Forum at 2022 IEEE Haptics Symposium, 2022.
- **W2. Hagenow, M.**, Zinn, M., Fong, T., Laske, E., and Hambuchen, K. "Affordance Template Registration via Human-in-the-loop Corrections," Advances in Space Robotics and Back to Earth Workshop at 2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2021.
- **W1.** Zhang, B., **Hagenow, M.**, Mutlu, B., Zinn, M., and Gleicher, M. "Characterizing the Effects of Haptic Rendering Parameter Variations on Perceived Kinesthetic Rendering Accuracy," 2021 IEEE World Haptics Conference (WHC), 2021, pp. 868-868.

## Mentoring and Advising

I actively serve as a principal research mentor for multiple students per year as part of independent studies and NSF REUs. I meet with all research mentees on a weekly basis to establish research goals, brainstorm, and grow skills for future careers. Students have consequently been admitted to top robotics graduate programs (e.g., University of Pennsylvania, Carnegie Mellon University, Georgia Tech, University of Washington).

## Graduate Students

Megh Doshi

- 2020-Present • Design of a mobile bidirectional haptic input

## Undergraduate Students

Mohamed Safwat

- 2021-Present • State Estimation and Methods for 6D Input

Ahmed Khalil

- 2021-Present • State Estimation and Methods for 6D Input

Kevin Macauley

- 2021-Present • Affordance Template Registration Using Corrections

Nicole Gathman

- 2021 • Affordance Template Registration Using Corrections

## **Yash Hindka**

- 2021 • Dynamic camera during robot teleoperation via UAV

## **Michael Matuszewski**

- Summer 2020 • Real-time force display for robot physical interaction

## **Saheen Feroz**

- 2019-2020 • Synopsis of robot trajectories and interaction using optimization

## Honors & Awards

### **Phi Kappa Phi**

- 2019 • UW-Madison

### **Mitchell Fellowship**

#### **(Instructional Design)**

- 2018 • The Mitchell Institute

### **O'Leary Design Award**

- 2014 • Tufts University

### **Tau Beta Pi**

- 2014 • Tufts University

### **Senator George J. Mitchell Scholarship**

- 2010 • The Mitchell Institute

### **Rensselaer Medal**

- 2009 • Rensselaer Polytechnic Institute

## Invited Talks

- NASA University Leadership Initiative Tech Talk (9/2021)

- NASA Intelligent Robotics Group (IRG) (7/2021)

- NASA Transformative Aeronautics Concepts Program (TACP) Showcase (2/2021)

## Teaching

### **Formal Instruction**

#### Guest Lecturer, ME739 - Advanced Robotics

- 2020 • UW-Madison

#### Instructor of Record, ME346 - Intro to Feedback Controls

- 2019 • UW-Madison

#### Teaching Assistant, ME739 - Advanced Robotics\*

- 2019 • UW-Madison

#### Teaching Assistant, ME346 - Intro to Feedback Controls

- 2018 • UW-Madison

#### Teaching Assistant, ME446 - Automatic Controls\*

- 2018-2019 • UW-Madison

#### Teaching Assistant, ME370 - Energy Systems Laboratory

- 2018 • UW-Madison

#### Teaching Assistant, COMP11 - Intro to Computer Science

- 2013-2014 • Tufts University

\* Distance Learning

### **Extracurricular**

#### Teaching-As-Research Project (Delta Program)

- 2019 • How does problem-based learning instruction of loop-shaping in the frequency domain affect student adaptive expertise and student perceived value of material?

#### Tutorial Contributor (CTMS)

- 2018-2021 • Developing tutorial for Lead motor position control (In Progress). Tutorials will be hosted on the official website (<http://ctms.engin.umich.edu>).

#### Lab Development

- 2018 • Developed real time control platform using Simulink and three labs (system identification, PID, and Frequency Domain Lead Control). Fabricated 10 control platforms using industrial connectors and hardware (B&R Automation). Co-authored posters at the 2018 Midwest Robotics Workshop (TTIC) and 2018 ADEIL Conference.

## Academic Services

### **Referee Services**

- IEEE Robotics and Automation Letters (RAL)

- International Journal of Social Robotics (SORO)

- Human-Computer Interaction

- IEEE International Conference on Robotics and Automation (ICRA)

- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)

- Artificial Intelligence for Human-Robot Interaction (AI-HRI)

## Organization

- Co-organizer - Wisconsin Robotics Seminar Series (<https://robotics.wisc.edu/seminar-series/>)
- Co-chair - PHRI & Shared Autonomy for PHRI sessions at IROS 2021

## Recent Service

Workshop Volunteer, New Educator's Orientation

- 2019-2022 • UW-Madison

REACH Lab Tours (3-5 Annually)

- 2018-2021 • UW-Madison

Volunteer Tutor - Algebra/Geometry

- 2018-2019 • West High School

Engineering Expo

- 2019, 2022 • UW-Madison

Alumni Interviewer

- 2017-2019 • Tufts University

Event Supervisor - Mechatronics & Aerial Scrambler

- 2019 • Science Olympiad

## Technical Skills

### Programming:

- Python • C/C++ • CUDA • Java • HTML/CSS/JS

### Tools:

- ROS • V-REP • git •  $\text{\LaTeX}$  • CMake

### Robotic Platforms:

- Franka Emika Panda • Rethink Sawyer • UR3/UR5 • Kinova Mico/Jaco

### Engineering:

- Solidworks • Matlab • Simulink (control system design certified) • Labview • EES