Saad N. Yousaf

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EDUCATION

The University of Texas, Austin, Texas — Aug 2019 – Present
Ph.D. in Mechanical Engineering, NSF Graduate Research Fellow — GPA: 3.96/4.00
ReNeu Robotics Lab, Advisor: Dr. Ashish D. Deshpande

Rice University, Houston, Texas — Aug 2015 – May 2019
B.S. in Mechanical Engineering, Minor in Engineering Design — GPA: 4.10/4.00
B.A. in Asian Studies

Computer Skills: SolidWorks, MATLAB, Simulink, LabVIEW, C++, C#, Unity, R, Microsoft Suite

Research Interests: Physical Human-Robot Interaction, Wearable Robotic Devices, Design and Human Factors, Attachment Interface Design, Human-Centered Robotics, Haptics and Teleoperation, Biofeedback

HONORS AND AWARDS

NSF Graduate Research Fellowship Program (GRFP) — Aug 2020 – Present
Cockrell School of Engineering Fellowship, UT Austin — Aug 2019 – Present
Provost's Graduate Excellence Fellowship, UT Austin — Aug 2019 – July 2020
Best Robotic Technology Project, Rice Engineering Design Showcase — April 2019
Rice Trustee Distinguished Scholarship — Aug 2015 – May 2019

JOURNAL PUBLICATIONS

Ghonasgi, K.*, **Yousaf, S.N.***, Esmatloo, P., and Deshpande, A.D. "A Modular Design for Distributed Measurement of Human-Robot Interaction Forces in Wearable Devices." Sensors 21 (4). 2021.

Yousaf, S.N., Joshi, V.S., Britt, J.E., Rose, C.G., and O'Malley, M.K. "Design and Characterization of a Passive Instrumented Hand." ASME Letters in Dynamic Systems and Controls 1 (1). 2020.

CONFERENCE PROCEEDINGS

Yousaf, S.N., Mukherjee, G., King, R., and Deshpande, A.D. "Estimation of Interface Power During Physical Human-Robot Interaction in Hand Exoskeletons." Submitted to the IEEE International Conference on Robotics and Automation (ICRA) in London, United Kingdom. June 2023. *Under Review.*

Yousaf, S.N., Ghonasgi, K., Esmatloo, P., and Deshpande, A.D. "Human-Robot Interaction: Muscle Activation and Angular Location Affect Soft Tissue Stiffness." Proceedings of the IEEE International Conference on Biomedical Robotics and Biomechatronics (BioRob) in Seoul, South Korea. August 2022.

Yousaf, S.N., Ghonasgi, K., Esmatloo, P., and Deshpande, A.D. "An Actuated Indenter for Characterization of Soft Tissue Towards Human-Centered Design." Proceedings of the IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM) in Delft, The Netherlands. July 2021.

Yousaf, S.N., Esmatloo, P., Ghonasgi, K., and Deshpande, A.D. "A Method for the Analysis of Physical Human-Robot Interaction." Proceedings of the IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM) in Delft, The Netherlands. July 2021.

PRESENTATIONS

Yousaf, S.N., Ghonasgi, K., Esmatloo, P., and Deshpande, A.D. "Human-Robot Interaction: Muscle Activation and Angular Location Affect Soft Tissue Stiffness." UT CARE Research Day Poster Presentation. 2022.

Yousaf, S.N., Ghonasgi, K., Esmatloo, P., Varghese, R.J., and Deshpande, A.D. "Physical Human-Robot Interaction in Wearable Devices." Texas Robotics Symposium Poster Presentation. 2020.

Anderson Z., Jeffress N., Kim J., Mesta, E., Rupp J., **Yousaf, S.N.** "Torque Feedback for Subsea Robotics." Rice Engineering Design Showcase. 2019. Best Robotics Project Award.

RESEARCH EXPERIENCE

Wearable Hand Device Attachment Design, *ReNeu Robotics Lab* Aug 2020 – Present
Principal Investigator: Dr. Ashish D. Deshpande

- Developed a simulation in Simscape Multibody for a wearable hand device to analyze the effects of contact area, robot linkage flexibility, and interface stiffness, validating simulation results with the Maestro hand exoskeleton
- Proposed a novel method to estimate interface power in wearable hand devices to evaluate interaction performance

Physical Human-Robot Interaction, *ReNeu Robotics Lab* Aug 2019 – Present
Principal Investigator: Dr. Ashish D. Deshpande

- Validated a human-centered design approach for a variable stiffness forearm attachment using a holistic evaluation method with a novel sensorized cuff design for the distributed measurement of interface pressure
- Designed a novel actuated indenter for characterization of human soft tissue properties with force feedback
- Analyzed physical human-robot interaction in an upper arm exoskeleton cuff with an FEA simulation

Harmonic Drive Torque Sensing, *Houston Mechatronics Inc. (HMI)* Aug 2018 – Aug 2019

- Worked with a senior design team to research, design, and implement a novel strain gage torque measurement system based on input motor position for HMI's underwater harmonic-drive robot arm joints
- Analyzed the sensitivity of measurements based on sensor accuracy and developed a torque prediction model
- Interned at HMI to integrate the torque sensing project into the company's

Instrumented Hand and MAHI Exo-II, *MAHI Lab* Apr 2017 – May 2019
Principal Investigator: Dr. Marcia K. O'Malley

- Designed and fabricated an instrumented hand for accurately measuring motion actuation from a robotic glove, focusing on design for manufacturability with plastic parts while incorporating sensing electronics
- Tested the range of motion for a hand exoskeleton with the instrumented hand to inform wearable device design
- Designed the incorporation of force-torque sensors and a new upper arm cuff with a focus on manufacturability of metal part design in the MAHI Exo-II, an upper extremity exoskeleton which is used for rehabilitation

DESIGN EXPERIENCE

Mechanical Engineering Intern, *Houston Mechatronics Inc. (HMI)* May 2018 – Aug 2018

- Worked with an interdisciplinary team to design and analyze the central electronics housing for Aquanaut, an untethered subsea service robot, with a focus on design for assembly, wire routing, and thermal analysis
- Designed and constructed a vision system test bed including rotary and linear actuators for automation development

Design Intern, *Oshman Engineering Design Kitchen (OEDK)* June 2016 – May 2017

- Designed, built, and tested a 3D printed forearm rotation measurement device to improve prono-supination measurements for cerebral palsy patients undergoing physical therapy at Shriners Hospital
- Collaborated with students from Brazil and Malawi to learn new perspectives for engineering design solutions

MENTORSHIP EXPERIENCE

Grace Li, B.S. in Electrical and Computer Engineering (UT Austin) October 2022 – Present
Actuator Controller Mechatronics for the Maestro Hand Exoskeleton

Victor Guzman, B.S. in Mechanical Engineering (UT Austin) Aug 2022 – Present
Variable Stiffness Cuff Design with Distributed Interface Force Sensing

Aditya Pawar, High School Student (Polygence) June 2022 – Present
Optimization of End Effector Design for General Robotic Manipulation

Zi Chuen Ooi, High School Student (Polygence) Apr 2022 – Present
Optimal Manipulator Arm Design to Address Common Mobility Injuries for Senior Citizens

Dhruv Bantval, Middle School Student (Polygence) Apr 2022 – Dec 2022
Smart Glove with ASL-to-Speech Conversion to Assist the Hearing Impaired
Praneel Magapu, High School Student (Polygence) May 2022 – Oct 2022
Using Virtual Reality in Behavioral Therapy to Address Phobias and Improve Patient Outcomes
Karma Desai, B.S. in Biomedical Engineering (UT Austin) May 2022 – Aug 2022
Attachment Interface Design for the Maestro Hand Exoskeleton

TEACHING EXPEREINCE

Rice University Teaching Assistant, *Introduction to Engineering Design* Aug 2017 – May 2018
- Mentored student design teams applying the engineering design process for projects with local clients such as the Houston Zoo, the Children's Museum of Houston, and NASA

Rice University Learning Assistant, *Introduction to Engineering Computation* Aug 2016 – May 2017
- Taught MATLAB programming by lesson planning for weekly lectures and holding student office hours
- Covered computational concepts such as Newton's method, matrix algebra, optimization, graph theory, etc.

ACTIVITIES

McMurtry College Bike Team, Captain Jan 2017 – May 2019
Rice Orientation Week (O-Week) Advisor Aug 2016 – May 2019
Rice Peer Academic Advisor, O-Week PAA, Head PAA Aug 2016 – May 2019
Rice Muslim Student Association, President Aug 2015 – May 2019

ORGANIZATIONS

Phi Beta Kappa Honor Society
Tau Beta Pi Engineering Honor Society
American Society of Mechanical Engineers