Naveed Riaziat

nriaziat | nriaziat | naveedriaziat.me | nriaziat@jhu.edu | (408) 891-3241

Education

PhD Mechanical Engineering **Johns Hopkins University** 2020-Present
Advisor: Prof. Jeremy D. Brown
PhD Candidacy: December 2023
MSE Robotics **Johns Hopkins University University** 2020-2022
BS Mechanical Engineering **Purdue University** 2016-2020

Publications

1. Riaziat, N. D., Erin, O., Krieger, A. & Brown, J. D. Investigating Haptic Feedback in Vision-Deficient Millirobot Telemanipulation. *IEEE Robotics and Automation Letters* **9,** 6178–6185 (2024).

2. Machaca, S., Karachiwalla, Z., Riaziat, N. D. & Brown, J. D. *Towards a ROS-based Modular Multi-Modality Haptic Feedback System for Robotic Minimally Invasive Surgery Training Assessments* in *2022 International Symposium on Medical Robotics (ISMR)* ISSN: 2771-9049 (Apr. 2022), 1–7. http://dx.doi.org/10.1109/ISMR48347.2022.9807479.

3. Miller, A. J., Riaziat, N. D. & Brown, J. D. *An Open-Source Ungrounded Hapkit for Educational Applications* in *2021 IEEE World Haptics Conference (WHC)* (July 2021), 1155–1155. http://dx.doi.org/10.1109/WHC49131.2021.9517254.

Projects

Thermal Sensing for Smart Autonomous Electrosurgery

- Subject of LinkSIM graduate fellowship research grant.
- Implemented custom automated test platform for evaluating electrosurgical cut performance.
- Design an optimization based algorithm to determine cut velocity during electrosurgical tumor resection.
- Integrated thermal sensor for heat damage and contact force estimation using Unscented Kalman Filter.
- Characterized performance against naive cut velocity on both synthetic and ex-vivo tissue.

Haptic Feedback for Ungrounded Magnetically Actuated Robots [1]

- Developed real-time localization and control framework using OpenCV, Python, and C++.
- Designed novel EMI-resistant force sensing PCB and brain aneurysm phantom for mock aneurysm coiling task.
- Conducted an n=23 user study to evaluate the impact of haptic feedback on low-vision robot teleoperation.
- Published in Robotics and Automation Letters, presented at ICRA@40.

Control Arbitration for Robot-Assisted Minimally Invasive Surgery

- Designed trackers for custom tool localization via Atracsys Fusion Track camera.
- Developing blending-mode controller with haptic feedback to improve performance on electrocautery disection.
- Automated tissue tumor margin detection for trans-oral tongue resection.

Multi-Modality Haptic Feedback for Surgeons [2]

- Evaluated impact of multiple haptic modes on surgeon performance (vibrotactile and wrist squeezing).
- Implemented signal processing algorithm to render haptic feedback from contact accelerations while preserving spatial and frequency characteristics.
- Adapted offline FFT algorithm to run online in C++.
- Integrated user study data collection system in ROS.

"An Open-Source Ungrounded Hapkit for Educational Application" [3]

- Presented at 2021 IEEE World Haptics Conference, Published in IEEE Xplore.
- Created a pedagogical tool for teaching ungrounded haptic interface design using simple off the shelf components.
- Modified open-source tools with additional sensors and software (control on Arduino and visualization in Processing).

Wireless Smart Obturator (sponsored by Intuitive Surgical)

- Led design team to reduce complication rate in first-access procedures.
- Designed high signal fidelity low-power PCB to measure strain gauges and 6-DoF obturator pose from IMU (via Madgwick Filter) on ARM Cortex-M4 microcontroller.
- Purdue Abstract Link

Autonomous Power-Line Inspection Vehicle

- Presented at 2019 Purdue Industrial Advisory Committee meeting.
- Design OpenCV algorithms for novel IR-light based localization to control a non-holonomic robot with poor dynamic performance in rough terrain.

Work Experience

Algorithms Intern Intuitive Surgical — May - Aug 2023

- Worked in the Ion Bronchoscopy Robot Advanced Product Development team.
- Designed and Implemented robotic algorithms for added functionality in future generations.

Mechanical Engineering Intern Intuitive Surgical — May - Aug 2020

- Developed hardware, software, and electronics for new testing equipment.
- Implemented PLCs to control and measure electromechanical systems.
- Performed dynamics analysis for life cycle evaluation and material selection.

Mechatronics Intern Intuitive Surgical — May - Aug 2019

- Introduced Electromechanical Systems and Study Tools for Improved Testing.
- Analyzed Workflow and Operating Room (OR) integration.
- Coordinated with CDE's, Surgeons, Engineers to Inform Design Requirements.

CMC Manufacturing Eng. Intern Rolls-Royce High Temperature Composites — May - Aug 2018

- Introduced novel machining fixtures for 5-Axis Machines.
- Instated Tool Tracking to predict tool wear.
- Launched SOP/TI development for new capabilities.

Motion Algorithms Intern TDK Invensense — May - Aug 2018

- Developed Motion Algorithms for navigation with 9-axis MEMS.
- Streamlined signal processing with Python, C++, MATLAB to be implemented on FPGAs.
- Leveraged time and frequency domain signal analysis for motion identification.
- Characterized sensor performance in high shock or vibration environments.

Skills and Coursework

Software:	C++, Python, OpenCV, MATLAB, ROS, Linux
Hardware:	Solidworks, CAD/CAM, DFM, GD&T
Misc:	Bayesian/State Estimation, PCB Design, Microcontrollers
Robotics/Control:	Robust, Adaptive, and Nonlinear Control, Linear Systems, Algorithms for Sensor Based Robots, Robot Kinematics and Dynamics
Mathematics:	PDEs, Linear Algebra, Basic Group Theory
Other Coursework:	Mechatronics (TA), Electromechanical Motion Devices, Digital Logic Design, Analog Circuit Design, Haptic Interface Design (TA), Human Robot Interaction

Awards

LinkSIM Graduate Fellowship July 2023

NSF GRFP Honorable Mention May 2020

LCSR Distinguished Graduate Fellowship Aug 2020

Purdue Senior Design First Place May 2020

– "Smart Tool for First Access in Laparoscopic Procedures"

Purdue Presidential Scholarship Aug 2016 - May 2020

Purdue Bottomely Scholarship 2019

– Awarded to select Purdue Mechanical Engineering Undergraduate Researchers