Mishek Jair Musa

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Portfolio Website: https://mjmusa.github.io

EDUCATION

PhD in Mechanical Engineering — Anticipated May 2024

University of Arkansas, Fayetteville, AR
GPA: 3.89
Supervisor: Prof. Uche Wejinya

Master of Science in Mechanical Engineering — December 2021

University of Arkansas, Fayetteville, AR
GPA: 3.88
Supervisor: Prof. Yue Chen
Thesis Title: Respiratory Compensated Robot for Liver Cancer Treatment

Bachelor of Science in Mechanical Engineering — May 2019

University of Arkansas, Fayetteville, AR
GPA: 3.64
Minor: Mathematics

Associate Degree of Science in Math and Physics — June 2016

St. John's College Junior College, Belize City, Belize
GPA: 3.53

SKILLS

Software: Solidworks, Autodesk Fusion 360, Autodesk Inventor, EAGLE, Microsoft Office Suite, LaTeX, Blender, GIMP

Programming Tools & Languages: MATLAB & Simulink, Python, Arduino, TensorFlow, Scikit-Learn, Git, Raspberry Pi, NVIDIA Jetson Nano, C++, HTML5

Manufacturing: Additive Manufacturing (FDM, SLA, and SLS 3D printing), Milling (CNC and Manual), Lathe (Manual), Soft Robot Fabrication, Laser Cutting, PCB design

Language: English (fluent), Belizean Creole (fluent), Spanish (conversational)

PROJECT & WORK EXPERIENCE

PhD Researcher and Teaching Assistant — January 2022 – Present

University of Arkansas, Fayetteville, AR

- Design and analysis of robotic systems for industrial applications
- Control system design and investigation of learning-based control strategies

Master's Researcher and Teaching Assistant — June 2019 – December 2021

University of Arkansas, Fayetteville, AR

- Design, analysis, fabrication, and characterization of several robotic devices for percutaneous needle insertion procedures under intraoperative image-guidance
- Design and fabrication of soft robots for experimental validation of theoretical research, and design and fabrication of soft sensors for head motion detection in the MRI environment
- Authored several journal and conference papers, and assisted in the writing of several grants and proposals
- Supervised 6 undergraduate students conducting senior design projects and undergraduate honors research

Lead Mechanical Engineer — August 2018 – May 2019

University of Arkansas Razorbotz, Fayetteville, AR

- Lead mechanical engineer for the excavation subsystem team for the NASA Robotics Mining Competition Team
- Supervised a team of 10 fellow undergraduate mechanical engineers
- Designed and built a functioning robot to perform excavation tasks in a simulated Martian environment

Assistant Engineering Technician June 2015 – August 2015

Guerra's Engineering Ltd., Belize City, Belize

- Assisted a technician in the installation, maintenance and servicing of air-conditioning units, refrigeration appliances and various electrical appliances.
- Assisted in the construction and installation of air-duct systems

TEACHING EXPERIENCE

Graduate Teaching Assistant August 2019 – Present

University of Arkansas, Fayetteville, AR

- **Spring Semester 2022**
  Lead Teaching Assistant for MEEG 3223 Introduction to Mechatronics – 46 students
- **Fall Semester 2021**
  Teaching Assistant for MEEG 3223 Introduction to Mechatronics – 24 students
- **Spring Semester 2021**
  Teaching Assistant for MEEG 3223 Introduction to Mechatronics – 90 students
- **Fall Semester 2020**
  Teaching Assistant for MEEG 3223 Introduction to Mechatronics – 15 students
- **Spring Semester 2020**
  Teaching Assistant for MEEG 3223 Introduction to Mechatronics – 15 students
  Teaching Assistant for MEEG 4213 Control of Mechanical Systems – 20 students
- **Fall Semester 2019**
  Teaching Assistant for MEEG 3223 Introduction to Mechatronics – 15 students
  - Assisted in the development of a new course in Mechatronics with focus on hands-on labs in Arduino programming, circuit building, and motor control

PUBLICATIONS

Journal Papers

- **M. J. Musa**, S. Sengupta, and Y. Chen, "Design of a 6 DoF Parallel Robotic Platform for MRI Applications," *Journal of Medical Robotics Research*, doi: 10.1142/S2424905X22410057
- **M. J. Musa***, A. B. Carpenter*, C. Kellner, D. Sigounas, I. Godage, S. Sengupta, C. Oluigbo, K. Cleary, and Y. Chen, "Minimally Invasive Intracerebral Hemorrhage Evacuation: A Review", *Annals of Biomedical Engineering,* **50**, 365–386 (2022). https://doi.org/10.1007/s10439-022-02934-z (* indicates co-first author)
- **M. J. Musa**, S. Sengupta, and Y. Chen, "MRI-Compatible Soft Robotic Sensing Pad for Head Motion Detection," *in IEEE Robotics and Automation Letters,* doi: 10.1109/LRA.2022.3147892.
- **M. J. Musa**, K. Sharma, K. Cleary, and Y. Chen, "Respiratory Compensated Robot for Liver Cancer Treatment: Design, Fabrication, and Benchtop Characterization," in *IEEE/ASME Transactions on Mechatronics*, doi: 10.1109/TMECH.2021.3062984.
- Q. Xiao, R. Monfaredi, **M. J. Musa**, K. Cleary, and Y. Chen, "MR-Conditional Actuations: A Review," in *Annals of Biomedical Engineering* 48, 2707–2733 (2020). https://doi.org/10.1007/s10439-020-02597-8

Conference Papers

- **M. J. Musa,** S. Sengupta, and Y. Chen, "A 6DOF MR Compatible Robotic Platform for Development of Motion Correction Technology," *in International Society for Magnetic Resonance in Medicine (ISMRM) Workshop on Motion Detection & Correction*
- S. Sengupta, **M. J. Musa,** and Y. Chen, "MoCoPad: A new soft sensor system for fast head motion detection and tracking in MRI," *in 31st International Society for Magnetic Resonance in Medicine (ISMRM) Annual Meeting*
- **M. J. Musa**, S. Sengupta, and Y. Chen, "Design of a 6 DoF Parallel Robot for MRI-guided Interventions," *2021 International Symposium on Medical Robotics (ISMR)*, 2021, pp. 1-7, doi: 10.1109/ISMR48346.2021.9661513.

- **M. J. Musa**, K. Sharma, K. Cleary, and Y. Chen, “Design and Workspace Analysis of a Patient Mounted Liver Ablation Robot,” in *11th National Image-Guided Therapy Workshop*.

Papers In Preparation

- **M. J. Musa,** U. Wejinya, “An Investigative Study of the Navigation of a Self-Balancing Robot in a Dynamic Environment”

PATENTS *(including pending)*

- Saikat Tarun Sengupta, Yue Chen, **Mishek Musa**, “Head Motion Correction in MRI Using a Soft Pressure Sensing Pad”, US Provisional Patent Application No. 63/306,067
- Yue Chen, **Mishek Musa**, Xiaofeng Yang, Nima Kokabi, “Image-Guided Robotic System and Method with Step-Wise Needle Insertion”, US Provisional Patent Application No. 63/299,304
- Yue Chen, **Mishek Musa**, “Respiratory Compensated Robot for Liver Cancer Treatment”, US Patent Application No. 17/525,461

CONFERENCE PRESENTATIONS

International Conference on Robotics and Automation (ICRA) May 23-27, 2022

Philadelphia, PA, USA (attended virtually)

- Presented on my research on the development of a novel MRI-compatible soft robotic sensing pad for head motion detection

International Symposium on Medical Robotics (ISMR) November 17-19, 2021

Atlanta, GA, USA

- Presented on my research on the design of a 6 DoF parallel robot for MRI-guided interventions

11th National Image-Guided Therapy Workshop April 16-17, 2020

Rockville, MA, USA (attended virtually)

- Presented on my research on the design and analysis of a patient mounted, respiratory compensated robot for liver cancer treatment

PROFESSIONAL DEVELOPMENT & ACTIVITIES

Technical Reviews

Provided technical reviews of publications submitted to:

- International Symposium on Medical Robotics (2022)
- IEEE Robotics and Automation Letters Special Issue: Autonomous Systems in Robotic Surgery (2021)

Memberships

- IEEE Student Member
- IEEE Robotics and Automation Society Member
- Pi Tau Sigma – International Mechanical Engineering Honor Society

Arkansas Summer Research Institute (ASRI) June 2022

Fayetteville, AR (held virtually)

A two-week intensive professional development event hosted by Arkansas NSF EPSCoR in collaboration with the Arkansas School for Mathematics, Sciences, & the Arts (ASMSA). The event is attended by students from Arkansas and the surrounding region. During the event, students learn a blend of technical skills and professional skills with particular focus on data science and machine learning.

Student Program for Innovation in Science and Technology (SPISE) July 2014

University of the West Indies, Barbados

Intensive four-week residential enrichment summer program for gifted Caribbean post-secondary students, modeled after the MITES program at MIT and is spearheaded by Dr. Cardinal Warde of the Electrical Engineering Department at MIT. Course work included physics, calculus, robotics, and electronics.

CERTIFICATIONS/AWARDS

- Certified SolidWorks Associate – License C-NUA8W3Y8QZ
- Treasurer of Pi Tau Sigma – International Mechanical Engineering Honor Society (2018 – 2019)
- University of Arkansas Caribbean Tuition Advantage Scholarship (2016 – 2019)

SERVICE

- Assistant for the University of Arkansas REU Site: Summer Internships in Nanomaterials, Nanomechanics, and Leadership Training in Engineering
- Graduate Student Panelist discussing experiences in graduate school and how to choose to attend graduate school to current REU participants at the University of Arkansas
- Mechanical Engineering Ambassador: Promote and inspire freshmen to join the Mechanical Engineering Department at the University of Arkansas through talks and presentations

References available upon request