Shreesh Mahapatra

E-Mail | LinkedIn| Google Scholar

EDUCATION

Indian Institute Of Technology, Kharagpur 2020-2025

Final Year UG - B.Tech+M.Tech Dual Degree Course - Mechanical Engineering & Master's Spl. in Mechanical Systems Design **GPA: 9.05/10**

Specialization Rank **One** in the Mechanical Systems Design specialization

Micro-Specialization: Embedded Controls, Software and Modelling - Advanced Technology Development Centre

Research Interests: Soft Robotics | Haptics | Bio-Inspired Robotics | Biomechanics | Control Systems | Computational Modeling | Neuro-Robotics

PUBLICATIONS

- **Mahapatra, S.***, Patra, S.*, and Godaba, H. "Multistable States and Snap-Through Instabilities in an Interconnected Dielectric Elastomer Actuators System." *ASME. J. Appl. Mech. May 2024; 91(5): 051006. (*Equal Contribution) [doi]*
- **Mahapatra, S.**, Bharat, B., Dash, S. M., Ranjan R., Godaba, H. Investigation of Non-linear forced vibrations of hyperelastic robotic fish fin: A perturbation technique approach. **[Under Review]** in the *ASME. Journal of Computational and Nonlinear Dynamics*
- Xu, S., **Mahapatra, S.**, Pham, D. T., Sarangi, M., Robotised unplugging of a cuboid plug press-fitted into a socket. **[In preparation to be submitted]** in the *Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science.*

RESEARCH EXPERIENCE

Joint Motion Sensor Developmemt | Dr.Arnab Palit | Warwick Manufacturing Group May 24 - July 24

- Developed a smart wearable sensor system using **IMU data** for real time joint motion measurement, validated through cadaveric studies
- Assessed **non-linear**, **weighted non-linear** optimization and **rotation matrix transformation** algorithms for knee joint angle computation
- Engineered a system for transforming local coordinates to CT geometry using advanced local-global coordinate transformation algorithms.

Control of Microrobots | Prof.Eric Diller | University of Toronto May 23 - Aug 23

- Automated a **millimetre-scale capsule endoscope** using a 3-axis robotic gantry system, with movement validation in porcine intestines
- Created two **neurosurgical tools**: a brain tissue cutter and a brain tissue sucker, using Resin printing and validated movements in pig brain
- Implemented PID control for precise joint angle regulation of a KUKA robot to manoeuvre neurosurgical tools during surgical interventions

Design, Simulation and Vibration Study of a Soft Robotic Knifefish | Prof. SM Dash | IIT Kharagpur May 24 - Present

- Fabricated a **soft robotic knifefish** using a EcoFlex mold and a 2:1 ratio gear and servo actuation system for replicating realistic swimming
- Analytically studied the mode shapes present in the fin using the **perturbation technique**, and determined overall equation of the fin
- Performed **2-way fully coupled FSI** simulation between **Ansys Fluent** and **Transient Structural** for the fish fin to analyze thrust and lift forces
- Utilized **k-epsilon model**, **Dynamic** and **Overset Meshing techniques** in Fluent, and Gent material model to assess material non-linearity

Interconnected Dielectric Elastomer Actuator System | Prof. Hareesh Godaba | University of Sussex Dec 21 - Dec 23

- Modeled state of three interconnected DEAs under various voltages in MATLAB by minimization of energy and Sylvester's stability criterion
- Conducted thorough analysis of **snap-through instabilities** in elastomers, exploring behaviors driving these instabilities under different conditions
- Discovered a **novel cascading instability behavior** in the inflated DEAs, revealing complex interactions under varying inflation pressures

Peg out of the Hole Problem | Prof. Duc T Pham | University of Birmingham May 22 - July 24

- Examined the experimental setups for robotic wire extraction from batteries and modeled stress and forces using **Ansys Static Structural**
- Investigated the wiggling unplugging motion in cuboid peg removal from the hole, analyzing various force amplitudes, frequencies 1- 2 Hz
- Analyzed interference effects in PVC-Al with interference variations 1 - 1.5 mm and Al-Steel combinations, in the 5 to 10 micron range

Investigating role of OFC in Auditory Circuits | Prof. Sharba Bandhopadhyay | IIT Kharagpur Mar 23 - Jan 24

- Performed behavioral experiments to study auditory processing in mice, specifically focusing on the **OFC**'s involvement in auditory circuits
- Customized a behavior training rig by configuring hardware and **NI DAQ** with **MATLAB**, along with developing a GUI for data acquisition
- Designed and conducted **discrimination tasks** with **negative reinforcement**, training mice to distinguish between "go" and "no-go" stimuli

Multimodal Control Inputs to a Smart Wheelchair | Prof. Banibrata Mukherjee | IIT Kharagpur May 22 - Feb 23

- Established manual wheelchair control using **resistance** and **vision-based tactile sensors** with **Arduino** to achieve reliable and efficient operation
- Acquired EOG signals for steering wheelchair, using **Wavelet Transform**, **Frequency Domain Analysis** and **Template matching classification**
- Designed a **band-pass filter** circuit for signal processing and validated it with **Butterworth** Filtering for accurate EOG signal acquisition

POSITIONS OF RESPONSIBILITY

Controls Team Head | Autonomous Ground Vehicle Group May 2021 - May 2022

- Trained team members, developed advanced controllers such as Linear Quadratic Regulators and Model Predictive Controllers for AGVs
- Competed in team events such as the Indy Autonomous Challenge and the University Rover Challenge, managing the controls division

KEY SKILLS

Languages	Python, C, C++, Java, MATLAB, Bash, 8051 Assembly, Arduino, LaTeX
Frameworks & Softwares	SolidWorks, Fusion 360, COMSOL, ANSYS, ABAQUS, GAZEBO, Robotic Operating System (ROS/ROS2), RViz

SELECTED AWARDS, HONOURS AND SERVICES

Selected for **IITKGP-WMG Summer Internship Program** to work at **WMG, University of Warwick, Coventry, UK** 2024

Secured the Guru Krupa Foundation Scholarship USA for Summer Research Internship 2024 2024

Selected for **MITACS Globalink Research Internship** at the University of Toronto, ON, Canada. 2023

Secured a rank of 3132 in JEE-Main 2020 out of over **1.8 million candidates** and **6292 out of 200,000 candidates** in JEE-Advanced 2020 2020