Harsh Jashvantbhai Modi

College Station*, Texas, USA
(716) 295-3414
harsh.modi@tamu.edu
linkedin.com/in/harshjmodi

harsh-modi.com

OBJECTIVE

I am a PhD student in Mechanical Engineering with a research focus on robotics, control systems, and motion planning. Specifically, I am an expert in **quickly implementing theories into mechatronics hardware**. Looking for an internship for Spring/Summer 2025.

EDUCATION

Texas A&M University, College Station, TX | Doctorate – Mechanical Engineering | GPA: 4.0/4.0   ***[May'26]***
  Thesis: **Advancing robot autonomy with novel hardware designs and control algorithms**

IIT Bombay, Mumbai, India | Masters – Mechanical Engineering | GPA: 9.85/10.0   *[Aug'22]*
  Thesis: **Design and development of multirotor aerial robotic platform**

IIT Gandhinagar, Gandhinagar, India | Bachelors – Mechanical Engineering | GPA: 9.05/10.0   *[Aug'18]*
  Project: Design and development of wheat harvester for small farms of India

SKILLS

Software   : Robot Operating System (ROS1 & ROS2), Python, C++, Gazebo, Rviz, sensor fusion, MATLAB, Simulink, SolidWorks, Autodesk Inventor, ANSYS, GIT, LaTeX
Hardware   : Raspberry Pi, Arduino, Pixhawk, Microcontroller Applications, Additive Manufacturing, Motion Capture

RESEARCH EXPERIENCE

Control and Robotics Lab, Texas A&M University / University at Buffalo   *[Aug'22 –present]*
(Skills Used: ROS1&2, Python, Gazebo, MATLAB, Simulink, GIT, LaTeX, SolidWorks, Raspberry Pi, Pixhawk, Vicon)
- Developed Iterative Learning Control (ILC) with Disturbance Observer (DOB) for estimating and suppressing the disturbances via learning among systems with mismatched dynamics.
- Implemented the framework on quadrotor UAVs for wind disturbance and active suspension vehicle systems for road profile estimation: Reduced estimation accuracy by around 88% compared to conventional methods.
- Developing a novel 7 DOF UAV with capability to transform mid-flight to enhance reachability of the UAVs in difficult-to-access terrain.

Intelligent Dynamical Ubiquitous Systems Lab, IIT Bombay   *[Dec'20-Jun'22]*
(Skills Used: ROS1, Python, Gazebo, MATLAB, Simulink, GIT, LaTeX, Autodesk Inventor, Arduino, Pixhawk, Vicon)
- Designed and implemented a controller to control the oscillations of an unactuated pendulum attached to the quadrotor.
- Formulated an algorithm to gradually store the kinetic energy in the pendulum by increasing the oscillations to hit a plastic ball so that it passes through a target hoop; Achieved 90% repeatability.

School of Mechanical and Aerospace Engineering, NTU Singapore   *[May'17-Jul'17]*
(Skills Used: Solidworks, ANSYS, QGroundControl, MATLAB)
- Designed a mechanism to precisely control the attitude and to enable the transition between hover mode and fixed-wing mode of the Vertical Takeoff and Landing fixed-wing UAV.
- Optimized the design considering compactness and the strength requirements. Performed stress and deformation analysis in ANSYS during various iterations.
- Manufactured the final mechanism leveraging additive manufacturing and assembled the bicopter components such as Pixhawk flight controller, ESC, BLDC Motors and performed tests to evaluate the roll/pitch/yaw control.

SELECT PUBLICATIONS

- H. Modi, Z. Chen, X. Liang, and M. Zheng, "Improving Disturbance Estimation and Suppression via Learning Among Systems With Mismatched Dynamics," in *IEEE Robotics and Automation Letters*, vol. 9, no. 6, pp. 5238-5245, June 2024, doi: 10.1109/LRA.2024.3391026.
- Harsh J Modi, Mohammad R Hajidavalloo, Zhaojian Li, and Minghui Zheng, "Robust Iterative Learning for Collaborative Road Profile Estimation and Active Suspension Control in Connected Vehicles," *MECC* 2024.

CURRICULAR PROJECTS

Robotics and Spatial Intelligence (ROS2, Python, GIT, Rviz, MATLAB)   *[Jan'24-Apr'24]*
- Using noisy 2D LiDAR data, detected moving objects among background stationary objects, and tracked each unique object even if they were "shadowed" by other objects temporarily.
- Using very low resolution and low refresh rate 2D LiDAR data, created a probabilistic occupancy grid map of the environment the robot was moving in.
- Identified the map in which the robot was moving among known stored maps using the created occupancy grid, achieved 100% accuracy after a few scans.
- Implemented a visibility graph-based motion planning algorithm to move the robot to goal location avoiding the obstacles, used Dijkstra's algorithm to find the shortest path.

Advanced Topics in Mobile Robotics (ROS1, Python, Gazebo)   *[Jan'21-Apr'21]*
- Designed a controller using ROS to move a wheeled robot to a desired location based on target setpoints.
- Designed an Extended Kalman Filter based estimation algorithm to use the trilateration data to localize the robot.
- Analyzed and recreated a paper focusing on monitoring and mapping the aggressive fire spread using multiagent UAVs.
- Designed a MATLAB simulation to recreate the algorithm: UAV agents schedule a meeting to exchange their beliefs on the state of each grid point as healthy/on fire/burnt in a decentralized manner.

Computer Aided Simulations of Machines   *[Jan'21 – Apr'21]*
- Modeled the trailing edge flap mechanism (fowler flaps) of Airbus A320 in SolidWorks based on data available in the literature.
- Simulated and analyzed the motion in ADAMS to determine required torques at various motor speeds and flap levels.

INDUSTRIAL EXPERIENCE

Tata Motors Ltd. – **Commercial Vehicle Business Unit**, Pune, India   *[Aug'18-Aug'20]*
Senior Manager; "Advance Quality – Purchase & Supplier Quality"
- Developed about 150 automobile parts with tier-1 suppliers for implementation of BS VI emission norms in India.
- Led a team responsible for supplier selection, monitored continuous timely development of the tools, and ensured adherence to the quality standards with various labs in the company.
- Conducted onsite PPAP assessment to ensure the production at a required rate with quality and managed initial supply to the production line before handing over to supply chain department.
- Improved designs of about 50 parts by providing "Design for Manufacturing" feedback to the design team for future projects.