PRATHAMESH SARAF

psaraf@ucsd.edu |+1-(619)-953-8290 | Website | Google Scholar | Github | LinkedIn | La Jolla, CA

EDUCATION

University of California, San Diego — San Diego, USA
MS in Electrical & Computer Engineering (Intelligent Systems, Robotics, & Controls) — *Expected Mar 2024*
Courses: Robot Motion Planning, Sensing and Estimation, Linear Algebra, Non-Linear Controls, Convex Optimization, Co-operative Control of Multi-Agent Systems, Stochastic Processes in Dynamic Systems

Birla Institute of Technology & Science, Pilani — Hyderabad, India
B.E. Electronics & Instrumentation; Minor in Robotics & Automation — *2017-2021*
Courses: Modern Control Systems, Control Systems, AI for Robotics, Robotics

SKILLS

Software/Tools: MATLAB, Simulink, Gazebo, Webots, PyBullet, MuJoCo, Solidworks, Fusion 360, AUTOCAD, Solidworks Electrical, DraftSight, Git, LabVIEW, Allen-Bradley PLC, Linux Systems
Programming Languages/Frameworks: ROS, Python, C/ C++, HTML, Verilog, PLC Programming

EXPERIENCE

Dynamics and Controls Intern, **N Robotics** — *May 2023 - Sept 2023*
- Built a biped robot from scratch and designed its gait patterns and transitions, zero-moment point stability analysis, state estimator, and whole-body model predictive controller, enabling multi-terrain stable locomotion.
- Implemented a linear policy for model-free control and inexpensive computation using the ROS-PyBullet framework.

Research Assistant, **Stochastic Robotics Lab, Indian Institute of Science** 🔗 — *June 2021 - May 2022*
- Led a team of 4 in developing velocity-based gait transitions, a state estimator, and a whole-body impulse control + model predictive controller, thereby increasing the stability of the 'Stoch' quadruped robot.
- Verified and optimized controllers using the OROCOS framework and ROS-Gazebo simulation, and presented our results to a space organization, paving the way for future collaboration.

Research Intern, **Multi-Agent Robotic Motion Lab, National University Singapore** 🔗 — *Jan 2021 - Nov 2021*
- Designed an inexpensive cost function using a gradient descent analysis of the ground reaction forces to obtain the required body pose, thus empowering stable multi-terrain hexapod robot locomotion.
- Increased the robot's stability by ~40% in PyBullet and Webots environment.

RELEVANT PROJECTS

Mobile Robot SLAM | *Python* 🔗 — *Jan 2023 - Mar 2023*
- Generated panoramic images of robot surroundings by optimizing quaternion trajectories via gradient descent.
- Constructed 2D occupancy grid maps of environments using Particle Filter SLAM via encoder and IMU odometry, 2D LiDAR scans, and RGBD measurements for texture map creation.
- Developed visual-inertial SLAM algorithm by synchronizing IMU and stereo-camera measurements and incorporating an Extended Kalman Filter based on stereo-camera observations.

Stable Gait Transitions of a Quadruped Robot using Predictive Control | MATLAB, C++ 🔗 — *Jan 2021 - June 2021*
- Developed quadrupedal gait transitioning between high-paced bound & medium-paced trot gait.
- Simplified the complex robot dynamics and designed a force-based model predictive controller.
- Evaluated the controller's performance for 'Spot' on uneven terrain enabling the robot to resist 1.5x the initial disturbance capacity and sustain falls from 2x its walking height in the Webots simulator.

Articulated Robotic Manipulators: Modeling, Simulation & Control | MATLAB, ROS 🔗 — *Sept 2020 - June 2021*
- Formulated a simplified and efficient Lagrange-Euler dynamic model requiring 30% fewer tunable parameters.
- Improved the accuracy of a KUKA IIWA LBR7 manipulator by 15%, with 90% less overshoot and 20% faster response using an impedance controller compared to optimal control in MATLAB & ROS environment.

PUBLICATIONS / PROJECT REPORTS

1. **P. Saraf,** M. Shaikh, M. Phan, "*Convex Optimization in Legged Robots*," Project Report MAE 227
2. **P. Saraf,** "Traffic Wave Dampening using Autonomous Vehicles," Project Report MAE 247 🔗
3. **P. Saraf,** Y. Jangir, R. N. Ponnalagu, "*Implementation and Testing of Force Control on a Spherical Articulated Manipulator*," IEEE International Conference on Mechatronics and Automation (ICMA), 2022
4. **P. Saraf,** et al, "*Terrain Adaptive Gait Transitioning for a Quadruped Robot using Model Predictive Control*," IEEE International Conference on Automation and Control (ICAC), 2021 🔗
5. **P. Saraf,** et al, "*Onboard Electrical, Electronics, and Pose Estimation System for Hyperloop Pod Design*," IEEE 7th International Conference on Control, Automation and Robotics (ICCAR), 2021 🔗
6. **P. Saraf,** R. N. Ponnalagu, "*Modeling and Simulation of a Point-to-Point Spherical Articulated Manipulator Using Optimal Control*," IEEE International Conference on Automation, Robotics, and Applications (ICARA), 2021
7. **P. Saraf,** M. Gupta, and A.M. Parimi, *"A Comparative Study Between a Classical and Optimal Controller for a Quadrotor,"* IEEE 17th India Council International Conference (INDICON), 2020
8. A. Agnihotri, **P. Saraf,** and K.R. Bapnad, "*A Convolutional Neural Network Approach Towards Self-Driving Cars*," IEEE 16th India Council International Conference (INDICON), 2019 🔗

TEACHING / LEADERSHIP

- **Electrical Subsystem Lead**, Hyperloop India, BITS Pilani — *Aug 2019 - Oct 2020*
- **Teaching Assistant** - Control Systems Laboratory, BITS Pilani — *Jan 2020 - May 2020*
- **Robotics Mentor** - Student Mentorship Program, BITS Pilani — *Aug 2019 - Dec 2019*