

Shreeram Murali

Curriculum Vitae

Last Updated: October 2023

RESEARCH INTERESTS

Combinations of: data-driven control, nonlinear control, mobile robot navigation, motion planning, vision-based control.

CONTACT INFORMATION

- **Email:** shreeram.m@gmail.com
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EDUCATION

Master of Science (M.Sc.) Electrical Engineering

Aalto University

Espoo, Finland

Aug 2023 – present

- Major: Control, Robotics, and Autonomous Systems
- Minor: Computer Science
- Received the Aalto University Category A Scholarship Award (100%)

Bachelor of Engineering (B.Eng.) Mechanical Engineering

Ramaiah Institute of Technology

Bangalore, India

Aug 2017 – Jul 2021

- Graduated: First Class (1st) with Distinction
- GPA: 9.37/10
- Best Achiever Award (outgoing class of 2021)

RESEARCH EXPERIENCE

Indian Institute of Science

Data Augmented Control of Autonomous Systems (DACAS) Lab

Junior Research Fellow

Advisor: Prof. Jishnu Keshavan

Aug 2021 – July 2023

My research at DACAS was mainly focused on control strategies that utilise visual cues to confer mobile robots with autonomy.

1. Vision-based adaptive leader-follower formation control of ground vehicles
 - Implemented and evaluated the performance of adaptive first-order sliding-mode control algorithms with and without prescribed-time convergence, prescribed error bounds, input constraints and state constraints for formation control in numerical simulation and experiments
 - Integrated and experimentally implemented an potential field method based obstacle avoidance scheme with the formation control strategy
 - Implemented a prescribed-time, prescribed-bound first-order sliding-mode control for formation control
 - Wrote ROS subscriber-publishers for navigation using sensor-data extraction using Python and C++ and publishing control inputs
 - Implemented a real-time object tracking using OpenCV based on fiducial markers such as AprilTags and ArUco markers to enable tracking at high FPS throughput
2. Autonomous landing of a quad-rotor using optic flow
 - Integrated motion capture data into the UAV's navigational control loop
 - Implemented controllers from existing literature to evaluate and compare performance against proposed control strategies

- Evaluated common UAV trajectory-tracking algorithms using software-in-the-loop simulations and studied their effect on path following and flight characteristics
- Developed a geometric path planning method for static obstacle avoidance based on Bezier-spline curves and assessed their impact on flight navigation
- Solved fluid-flow and heat-transfer problems numerically using MATLAB
- Conducted literature survey of recent papers and reproduced their numerical results

PUBLICATIONS

Publications:

- [C1]: Shubham Singhal, Jishnu Keshavan, and **Shreeram Murali**. “Constant Optical Flow Divergence based Robust Adaptive Control Strategy for Autonomous Vertical Landing of Quadrotors,” AIAA 2023-1150. *AIAA SciTech Forum*. January 2023. [\[link\]](#)

Preprints (accepted for publication):

- [J1]: Jishnu Keshavan, Saurabh Belgaonkar, and **Shreeram Murali**, “Adaptive control of a constrained first order sliding mode for visual formation convergence applications,” *IEEE Access*, 2023.

Manuscripts in review:

- [J2]: Saurabh Belgaonkar, Jishnu Keshavan, and **Shreeram Murali**, “A novel adaptive super-twisting control strategy for leader-follower formation tracking under visibility constraints,” *Elsevier Mechatronics*, 2023.

WORK EXPERIENCE

Tata Consumer Products

Software Engineer Intern (IoT)

Bangalore, India

Feb 2021 - Jul 2021

Development of IoT devices to monitor and dashboard internet user experience through performance parameters of cafés’ WiFi

- Developed Python scripts to run automatically on Raspberry Pi based IoT devices to read café parameters and push to a time-series database hosted on the cloud
- Deployed an InfluxDB time-series database on AWS cloud and created data dashboards for multiple user-cases using Grafana
- Configured multiple IoT devices to be deployed to cafés for remote monitoring
- Produced detailed technical documentation to aid IoT configuration for remote operation and debugging

PROJECTS

Crazypaths ([GitHub](#))

Dec 2021 – Jan 2022

- Package for polynomial path planning and trajectory-tracking for flying a quad-rotor (Bitcraze Crazyflie) with a motion capture system in the control loop.
- Package is capable of path planning, generating polynomial waypoints, pre-flight visualisation, and enables path-following aided by optic flow sensors and/or motion capture

- Defined an autopilot and flight navigation system weighing less than 250g incorporating multiple redundancies using the Pixhawk embedded system
- Improved flight navigational accuracy by tuning the aerial vehicle's on-board PID control systems and improved stability by diminishing oscillations
- Tested, gathered data, and validated system performance in over 100 hours of SITL simulations and 20 hours of flight time

ACTIVITIES

Team Lead, Edhitha Unmanned Aerial Systems

- Defined the electrical and mechanical architecture of an unmanned aerial vehicle of 6kg all-up weight
- Secured funding of over INR 200,000 in university grants and corporate sponsorships
- Took critical decisions regarding the selection of an airframe platform within a data-driven framework of technical, operational, and environmental constraints

Core-Team Volunteer, Numera

- Travelled to multiple schools in Bangalore to attract talented kids of diverse backgrounds to conduct a mathematics competition

Volunteer, Tata Volunteering Week

- Volunteered at a local hospital to conduct free health check-ups for people in underprivileged areas

CERTIFICATIONS

- **Basics of Robot Perception, AI & Robotics Technology Park, Indian Institute of Science:** Coordinate transforms, camera models, camera calibration, homographies, convolution and filtering, edge detection, feature descriptors (SIFT, HoG, SURF, ORB, R2D2), object tracking, optical flow, Hough transforms, RANSAC, feature-based pose estimation.
- **Numerical Methods for Engineers, The Hong Kong University of Science and Technology (Coursera):** Scientific Computing, Root Finding, Matrix Algebra, Quadrature and Interpolation, ODEs, PDEs using MATLAB
- **Probability and Statistics, University of London (Coursera):** Uncertainty Quantification, Hypothesis Testing, Inference, Monte Carlo methods
- **Basic Life Support**

AWARDS

- **Best Achiever Award** (outgoing class of 2021) for distinguished performance in Academics, Co-curricular, Extra-curricular Activities and Service to Community during 2017-2021 *by* Department of Mechanical Engineering

SKILLS

Software: Python, ROS, C, C++, MATLAB, Scala, SQL, InfluxDB, AWS, REST APIs

Engineering: EcoStructure, SOCs (Pi, Arduino, Jetson), ArduPilot, Fusion360

Fabrication: Additive Manufacturing, Computer Numerical Control (CNC)

Languages: English (bilingual native, professionally fluent)