Sesha N. Charla

PhD Candidate · Estimation and Control Systems · Purdue University · seshacharla.github.io
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Education

PhD in Mechanical Engineering
Purdue University - West Lafayette, Indiana — *August*, 2021 – *December*, 2025
Thesis: Model-based Fault Diagnosis using Set Membership Filtering for Nonlinear Systems under Uncertainty.
Research Focus: Estimation Theory, Adaptive Robust Control, Nonlinear Systems, Fault Diagnosis.

Masters in Aeronautics and Astronautics
Purdue University - West Lafayette, Indiana — *August*, 2019 – *May*, 2021
Major: Autonomy and Controls, Minor: Machine Learning (Reinforcement Learning and Computational Statistics)
Research: Simplex chains as control barrier functions for control under polytopic uncertainties and constraints.

Bachelor of Technology in Aerospace Engineering
Indian Institute of Space Science and Technology - Thiruvananthapuram, India — *August*, 2012 – *May*, 2016
Thesis: Finite Element Dynamic Model using Modified Lagrangian for Launch Vehicle Bending: Trajectory Simulations.

Experience Summary

- 8+ years of research and industry experience in control design, system identification, estimation and motion planning across automotive, aerospace, and industrial applications.
- PhD research focuses on Set-membership and Adaptive Robust Control for estimation, fault diagnostics, and control of nonlinear systems under uncertainties (diesel engine after-treatment systems, multirotor actuators).
- 2+ years experience training undergraduate and graduate students in control and estimation algorithms on embedded systems (STM32, NI-MyRio) for electromechanical systems.

Work Experience

Research Engineer - Estimation and Control Systems (Internship)
SC Solutions - Portland, Oregon — *May*, 2023 – *August*, 2023

- Developed auto-regressive estimation models for computer vision-based fat estimation in meat (USDA-funded project).
- Designed state and parameter estimation algorithms using vision data; implemented OpenCV-based real-time estimation software in C++.

Motion Control Engineer (Internship)
Virgin Hyperloop - Los Angeles, California — *June*, 2022 – *August*, 2022

- Designed and demonstrated supervisory control to minimize force mismatch across bogies, improving EM engine efficiency.
- Refined control architecture for EM engine using MATLAB/Simulink, demonstrating linear control limitations.
- Developed a MIMO model for guidance bogie engine assembly and analyzed robust stability and control performance w.r.t suspension parameters.

Scientist/Engineer 'SC', Test Instrumentation and Controls, Thermal Systems Group (Full-time role)
Indian Space Research Organization (ISRO) - Bengaluru, India — *July*, 2016 – *July*, 2019

- Led thermal instrumentation and control for 15+ satellite systems, including Chandrayaan-2 (orbiter, lander, rover).
- Developed a Python-based SCADA interface, doubling satellite test productivity and enabling simultaneous testing.
- Designed an optimal heater control and design tool with a web-based front-end, preventing burnout and saturation faults.

Technical Skills

Control and Estimation: Robust, Adaptive, Optimal & Nonlinear Control Design | Convex Optimization | Mathematical Modelling | Estimation & Detection (Kalman and Set-membership filtering)| System Identification | Signal Processing | Motion Planning and Trajectory Generation | Reinforcement Learning (MDPs and Dynamic Programming)

Programming: Python | MATLAB & Simulink | C | C++ (CMake, boost/eigen)| LabView

Embedded Systems: NI-RIO systems (LabView (FPGA, NI Real-time module), C++) | STM-32 (C, C++)

OS & Tools: Linux | Git | Jira | LaTeX| MS-Office Suit

R&D and Academic Experience

Diesel Engine Aftertreatment System Diagnostics *August*, 2023– Ongoing

- Developed a discrete nonlinear hybrid model for NO_x process dynamics in SCR-ASC systems; validated with test-cell & truck data.
- Formulated an aging diagnostics framework using set-membership filtering & parameter detection.

Actuator Fault diagnosis and robust control in Multi-rotors *August*, 2021– Ongoing

- Designed an RPM measurement system using back-EMF commutation signals (MECC'22) and developed a nonlinear model considering the ESC dynamics (ACC'24).
- Implemented Adaptive Robust Control for uncertainty rejection & fault-tolerant RPM tracking (MECC'24).
- Created a set-membership filtering & adaptive control-based fault-diagnostics framework.

Instructor/TA for Control Lab Courses *August*, 2020 – *May*, 2023

«««< HEADTaught C, Assembly, and LabView programming for closed-loop control of mechanical systems (e.g., inverted pendulum, DC motors, thermal systems). ***Course Development:*** Developed coursework on parameter estimation & robust control for a refrigeration system (ME 586) using STM32 Discovery board. ======= Assisted students in writing C, Assembly and LabView programs, and their debugging for developing closed loop control for mechanical systems such as inverted pendulum, DC motor and, heating and cooling systems using STM32 or NI-MyRio. ***Course Development:*** Demonstrated parameter estimation and robust control implementation procedures for refrigeration system with variable speed compressor and flow control valve (non-minimum phase system) using STM32 Discovery board as possible guided final project for the future course offerings of ME 586. »»»> $\text{tesla}_V ehicleDynamicsControls$ ***Relevant Course Work:*** Multivariable Systems and Robust Control | Adaptive Control| Detection & Estimation Theory | System Identification | Computational Statistics (EM algorithm) | Reinforcement Learning (Bandit problems and MDPs) | Nonlinear Systems | Vehicle Dynamics.

Honors, Scholarships & Service

- Reviewer for MECC, ACC and IFAC Journal of Mechatronics
- Graduate Research Assistantship from Cummins. Aging diagnostics of diesel engine after-treatment systems. [***Aug. 2023 - present***]
- Graduate Research Assistantship from NASA-ULI. Fault-diagnostics in urban air mobility systems. [***Aug. 2020 - 2021***]
- DOS-ISRO fellowship, Department of Space, India. Scholarship for undergraduate studies. [***Aug. 2012 - May. 2016***]
