

Sesha N. Charla

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Education

PhD in Mechanical Engineering

Purdue University - West Lafayette, Indiana

Fall, 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

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

2016

Thesis: Finite Element Dynamic Model using Modified Lagrangian for Launch Vehicle Bending: Trajectory Simulations.

Experience Summary

- 3 years of professional experience as Instrumentation and Control Systems Engineer for Satellite Systems. Internships at Virgin Hyperloop and SC Solutions.
 - More than 2 years of industry (Cummins) collaboration during PhD research.
 - Over 3 years of experience in development and implementation of advanced control and estimation algorithms for electromechanical systems on embedded platforms (STM32 (C), NI-MyRio (LabView)).
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Technical Skills

Control and Estimation: Robust (H_∞ , μ -syn), Adaptive (MRAC, ARC, RL), Optimal (MPC, LQG) & Nonlinear (Backstepping, Sliding Mode) Control Design | Convex Optimization (CVX, Gurobi) | Mathematical Modelling | Estimation & Detection (Kalman and Set-membership filtering) | System Identification | Signal Processing | Motion Planning and Trajectory Generation (RRT, A^*) | Reinforcement Learning (MDPs and Dynamic Programming)

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

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

OS & Tools: Linux | Git | Jira | L^AT_EX | EPICS Framework (Control Systems) | ROS

Work Experience

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. Explored implementation of field oriented control (FOC) of the PMSM drive for bogie propulsion.

- Developed a MIMO model for guidance bogie engine assembly and analyzed robust stability and control performance w.r.t suspension parameters.

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++.

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.
- Demonstrated the use of the EPICS framework on a test setup as a proof of concept for a unified SCADA system, as part of the proposed technology development program.

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

- Taught 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.

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**]