Sesha N. Charla

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Education

PhD in Mechanical Engineering
Purdue University - West Lafayette, Indiana   *December*, 2025
Thesis: Discrete Nonlinear Model-based Aging Diagnostics for Diesel Engine After-treatment Systems.
Research Focus: Advanced Control Design, Dynamics, System Identification, Estimation Theory, Adaptive Robust Control, Nonlinear Systems and Fault Detection

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.

Technical Skills

Control and Estimation: Advanced Control Design | Convex Optimization | Mathematical Modelling | Estimation & Detection | System Identification | Signal Processing | Motion Planning and Trajectory Generation | Inverse Kinematics | Reinforcement Learning

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 | LaTeX

Work Experience

System Analyst Intern (Robotic Algorithms and Controls)
Intuitive Surgical - Sunnyvale, California   *June*, 2025 − *August*, 2025

- Worked on fault diagnostics for motors in haptics of surgeon side console resulting in a new invention disclosure.
  - Implemented tools for detecting the new fault in the motors from the field data.
  - Developed and experimentally validated the analytical model of the motor operation under the newly diagnosed fault.
  - Developed the relationship between the residual and torque loss due to fault for validating thresholds.
- Proposed a spec change for hall sensors in a motor by validating it against motor safety algorithms and other specs on the same sensors that doubled the manufacturing process capability metric.

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***]