

Aashish Shaju

Controls engineer specializing in feedback control, state estimation, and physics-based modeling of complex dynamic systems. Proven experience in trajectory optimization (MPC), motion planning, and control algorithm design, with hands-on validation through simulations and experiments. Skilled in integrating fundamental principles with data-driven methods to develop scalable solutions. Background includes C++, Python, MATLAB/Simulink, and translating research into deployable systems for real-world applications.

 [linkedin.com/in/aashishshaju](https://www.linkedin.com/in/aashishshaju)
 : www.aashishshaju.com
 aashish00@vt.edu

Research and Professional Experience

- 1. Research Associate | Center for Vehicle Systems & Safety** Jan 2025 – present
Ultrasonic Acoustic Emission based Structural Health Monitoring
 - Designed and validated a real-time DAQ and signal-processing pipeline (MATLAB + embedded C++) for high-frequency ultrasonic measurements
 - Built custom analog signal-conditioning circuits (amplifiers, filters) to interface sensors with embedded hardware, ensuring high signal-to-noise ratios for reliable data analysis
 - Implemented classification tools using feature extraction and machine learning (DES Random Forest) to interpret sensor data and enhance diagnostic accuracy
- 2. Graduate Research Assistant | Virginia Tech (Ph.D.)** Aug 2021 – Dec 2024
 - Developed physics-based dynamic models for articulated vehicle systems using TruckSim and Simulink, enabling analysis of nonlinear and coupled system behavior
 - Designed and evaluated feedback control algorithms for autonomous systems, including integrated longitudinal-lateral controllers (clothoid-based trajectory tracking)
 - Performed stability, robustness, and sensitivity analyses through large-scale simulations to assess controller performance across operating conditions
 - Validated control designs through software-in-the-loop workflows, emphasizing scalability and reproducibility
- 3. Research Assistant | Vibration Research Lab, IIT Delhi** Sep 2020 – July 2021
 - Conducted NVH (Noise, Vibration, and Harshness) and acoustic analysis to support the development of a Health & Usage Monitoring System (HUMS) for military vehicles
 - Optimized sensor placement and extracted spectral and statistical features from vibration data (accelerometers) to build diagnostic models for vehicle subsystems (suspension/powertrain)
- 4. Graduate Research Assistant | IIT Hyderabad (MS)** Aug 2018 – June 2020
 - Modeled tire-road interaction forces and implemented the model in CarSim–Simulink co-simulation, running targeted simulations to evaluate handling, stability, and transient-steady-state discrepancies

Selected Technical Projects

- MPC-Based Trajectory Tracking:** Developed an MPC framework for a nonholonomic tractor-trailer system, incorporating system constraints and robustness analysis, validated on complex reference paths
- Multi-Sensor Nonlinear State Estimation for Robotic Platforms:** Developed and benchmarked EKF and UKF for a nonlinear tricycle robot, modeling stochastic steering and velocity via Markov processes and fusing multi-station radar measurements for real-time localization and state estimation

Publications (Selected)

- Shaju, A., et al.** “Passive Air-Coupled Ultrasonic Sensors for Wheel Crack Detection.” *Sensors*, 2025 <https://doi.org/10.3390/s25196126>
- Shaju, A., Southward, S., Ahmadian, M.** “Clothoid-Based Lateral Control for Autonomous Vehicles.” *Applied Sciences*, 2024 <https://doi.org/10.3390/app14051817>
- Shaju, A., Southward, S., Ahmadian, M.** “PID-Based Longitudinal Control of Platooning Trucks.” *Machines*, 2023 <https://doi.org/10.3390/machines11121069>
- Shaju, A., Pandey, A.** “Transient Response Modeling Using PAC2002 Tire Model.” *Vehicle System Dynamics*, 2020 <https://doi.org/10.1080/00423114.2020.1802048>

Education

Virginia Tech

Ph.D. Mechanical Engineering
Timeline: Aug 2021 - Dec 2024
GPA: 4.0/4.0 ([Thesis link](#))

IIT Hyderabad

M.S. Mechanical Engineering
Timeline: Aug 2018 - May 2020
GPA: 3.8/4.0 ([Thesis link](#))

Cochin University of Science and Technology

B.S. Mechanical Engineering
Timeline: Aug 2013 - May 2017
GPA: 3.6/4.0

Quantitative and Technical Skills

Control & Estimation

PID, LQR, MPC, adaptive control, Kalman filtering, state-space modeling

Modeling & Simulation

MATLAB/Simulink, TruckSim, CarSim, multibody dynamics, ADAMS, CAD (NX, Catia, SolidWorks), CAE (Ansys, Abaqus)

Estimation & Data

Kalman filtering, system identification, signal processing, feature extraction, Machine Learning (Random Forest, DES)

Programming

C++, Python, Embedded C++, Git, Real-Time DAQ, Sensor Integration

Experimentation

Real-time DAQ, sensor integration, analog signal conditioning, experimental design

Awards & Honors

Plenary Presentation: IAVSD 2025 (Vehicle Dynamics Conference)
Pratt Fellowship (Virginia Tech): 2022 for academic achievement