Arjun Nair

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Personal Statement

Detail-oriented aeronautical engineering graduate student with a robust foundation in mechanical design, aerodynamics, materials research, and applied data-driven engineering. Proven experience in developing validated numerical models, supporting experimental initiatives, and delivering practical engineering solutions within fast-paced, interdisciplinary teams. Energetic and resourceful professional with a strong aptitude for optimizing processes and enhancing operational efficiency. Proficient in data analysis and strategic planning, complemented by skills in project management and team leadership, dedicated to driving significant improvements and fostering a culture of continuous enhancement.

Education

Politecnico di Milano, Milan, Italy 2025 – Present
M.Sc. in Aeronautical Engineering

Vellore Institute of Technology, Vellore, India Aug 2021 – May 2025
B.Tech in Mechanical Engineering, Minor in Computer Science — CGPA: 8.4 / 10

Technical Projects & Research Experience

Aerodynamics Laboratory Project — Politecnico di Milano Oct 2025 – Dec 2025

- Developed MATLAB implementations of the Hess–Smith panel method and Weissinger lifting-line method to compute C_p, C_L, C_m, and induced-drag trends for airfoils and finite wings.
- Validated numerical outputs against XFOIL and XFLR5 reference data, achieving $< 2\%$ relative error in lift coefficient across multiple angles of attack.
- Compared NACA 0008 vs. AG26 airfoils at $Re = 3 \times 10^5$ to 5×10^5, quantifying transition and separation movement and its impact on aerodynamic coefficients.
- Evaluated low-speed aircraft configurations (including Cessna 172 comparison) to interpret lift distribution, tail downforce contribution, and induced drag sensitivity.

Machine Learning–Based External Braking Assistance Using Linear Actuator (B.Tech. Thesis II) Dec 2024 – Apr 2025

- Designed an external ECU-based brake pre-loading system for drum-brake vehicles, integrating LiDAR and Hall-effect sensors with a linear actuator for reduced brake response time.
- Developed and trained a linear regression model to predict optimal brake pre-loading force from real-time distance and wheel-speed data, deploying the model on an ESP32 microcontroller.
- Built and validated a servo-actuated braking prototype through bench and dynamic testing, demonstrating faster brake engagement with a low-cost, non-invasive aftermarket architecture.

Influence of Ball Milling and Reinforcements on Magnetism of Fe-Based Soft Magnetic Composites (B.Tech. Thesis I) Jun 2024 – Feb 2025

- Investigated the effect of high-energy ball milling and Al/Si reinforcements on Fe-based soft magnetic composites for EV and electromagnetic applications.
- Processed four powder compositions (Fe, Fe–Al, Fe–Si, Fe–Al–Si) using a planetary ball mill at controlled ball-to-powder ratio (10:1) and milling durations up to 4 hours.
- Characterized phase evolution and microstructural refinement using XRD, FE-SEM, and EDS, correlating particle size reduction ($< 2\ \mu$m) with reinforcement-assisted milling behavior.

Effects of Laser Shock Peening on Inconel 718 Superalloy Mar 2023 – Mar 2024

- Performed experimental and literature-based analysis on laser shock peening effects on surface integrity and fatigue-relevant surface parameters.
- Executed laboratory procedures including wire EDM specimen preparation and controlled laser shock peening trials on superalloy samples.

Clearing Earth's Orbit: Comparative Analysis of Active Debris Removal Strategies (SEDS-VIT) Feb 2023 – Sep 2023

- Conducted a structured literature review on active debris removal strategies and mission concepts as part of SEDS-VIT research initiatives.
- Prepared a technical study for submission to aerospace conferences, synthesizing feasibility, risk, and technology maturity considerations.

Professional Experience

Senior Operations Head — Seculinx (VIT Incubated Startup) Oct 2024 – May 2025
Vellore, India

- Led operations for a 30+ member multidisciplinary team, improving coordination across design, electronics, and manufacturing workflows.
- Oversaw CAD/CAM-driven prototyping cycles, ensuring dimensional accuracy, manufacturability, and on-time delivery of iterative product builds.
- Supported IoT system integration using ESP32-based sensor platforms, contributing to functional validation and deployment readiness of security solutions.

Aerospace Design Vehicle Project Intern — Brahmastra Aerospace & Defence Pvt. Ltd. Oct 2023 – Nov 2023
Pune, India

- Designed and simulated a hypersonic missile configuration operating at Mach 10 and 90,000 m altitude, accounting for compressible-flow effects and conical shock formation.
- Executed CFD analysis in ANSYS Fluent using the k–ω SST turbulence model, generating pressure, velocity, and lift/drag coefficient plots from converged solutions.
- Designed a NACA-based high-pressure turbine blade and performed modal analysis under combined centrifugal, axial, and rotational loads to assess structural integrity.

Mechanical Engineering Intern (CAD & R&D) — Super Technologies Pvt. Ltd. Sep 2023 – Oct 2023
Aerospace Division, Hyderabad, India

- Designed and detailed 25+ precision actuator components for the REMA-40M ballistic missile fin actuation system, adhering to DRDO drawing and dimensioning standards.
- Modeled complex assemblies including actuator housings, gear trains, rotor components, and sealing elements using advanced SolidWorks features.
- Produced fully dimensioned manufacturing drawings and resolved multi-constraint geometry issues, supporting downstream fabrication and assembly readiness.

Technical Skills

Engineering & Analysis: Aerodynamics, Finite Element Analysis, Materials & Composites, Experimental Methods, Numerical Modeling

Design & Simulation Tools: Computer-Aided Design (CAD), SolidWorks, ANSYS, MATLAB

Programming & Data: Python, Data Analysis, Machine Learning Fundamentals, Technical Documentation

Systems & Hardware: IoT, Embedded Systems, Sensors, Actuators

Operations & Reporting: Operations Management, KPI Reporting

Leadership & Activities

Johns Hopkins University — Hopkins Engineering Exploratory Program (Ambassador) Jun 2024

- Selected as a Program Ambassador from a competitive cohort, recognized for initiative, communication, and leadership.

- Engaged in one-to-one academic discussions with 25+ faculty members to explore research direction, graduate pathways, and professional development.

Toastmasters VIT — President Jan 2023 – May 2024

- Mentored 30+ members for competitive speaking; contributed to multiple national-level wins while managing club operations.

SEDS-VIT — Outreach Manager / Senior Core Member Jan 2022 – Jan 2025

- Organized 10+ outreach sessions for underserved schools and mentored students toward technical events and academic project execution.
- Supported space-education initiatives and contributed to conference-paper development within the chapter.

Student Organizer — Industry-Academia Networking Conclave (IANC) Jan 2024 – Mar 2024

- Coordinated a convention featuring 70+ mechanical companies, supporting research equipment showcases, hackathons, and internship drives.
- Hosted expert sessions and moderated discussions with visiting professionals across multiple technical domains.

Student Organizer — Yantra-VIT Apr 2023 – Jun 2023

- Organized a mechanical ideathon during Technical Week for 300+ students; built problem statements and structured participant onboarding.

Volunteer Experience

Teaching Underprivileged Children — Multiple NGOs Feb 2022 – Dec 2024

- Delivered classroom sessions and one-to-one tutoring (online and in-person), supporting academic development and study discipline.

Student Volunteer — ISRO World Space Awareness Week (VIT) Oct 2022

- Assisted ISRO scientists with event operations and delivered interactive sessions to 300+ school students on rocket evolution and space systems.

Certifications

SolidWorks — Python — G-Code — MATLAB — ANSYS — AI & Machine Learning — Excel

Languages

English (IELTS 8.5) — Hindi (Native) — Marathi (Native) — Italian (A2)