Rahul Joshi

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PROFESSIONAL SUMMARY

Results-driven Mechanical Engineer with 4+ years of experience in Design and Analysis, expertise in composite materials, structural mechanics, and finite element analysis. Proficient in static, dynamic, and Multiphysics simulations. Experienced in aerospace design standards and structural optimization. Skilled in applying Machine Learning Algorithms for both structural response prediction and material property estimation. Combines simulation-driven design with AI for advanced modeling, health monitoring, and failure analysis. Strong foundation in research and technical documentation.

SKILLS

Engineering Domain	Technical - Skill	Soft - Skill
1. Aircraft Loads and Structures [Design and Analysis Principles]. 2. Finite Element Analysis [Theory and Implementation]. 3. Mechanics of Composite Materials, Failure Theories. 4. Fatigue [Basics] 5. Computer Aided Design and Engineering. 6. Data Analysis [Principles and Application]. 7. Machine Learning.	1. ANSYS - [GUI and APDL (Problem Specific)] 2. LSDYNA - [GUI and Scripting] 3. SolidWorks 4. Python 5. Pandas, Tensorflow. 6. Langchain and Langgraph (AI Agent Tools). 7. Linux Systems.	1. Problem – Solving 2. First Principle Thinking Approach. 3. Communication. 4. Leadership.

PROFESSIONAL EXPERIENCE

Airframe Structures Analysis Engineer - 2	
Okulo Aerospace Private Limited – Bengaluru	Nov 2022 – May 2025
Roles and Responsibilities	
1. **Project:** Solar Electric Glider (Span: 3m, MTOW: 6 kg)	• Designed lightweight composite airframe using GF skin and CF sandwich core, balancing structural efficiency, material availability, and manufacturability. • Analysed operational loads; performed preliminary structural calculations (SFD, BMD, shell deformation) under FAR 14 Part 23 standards. • Developed load path layout; guided CAD modelling to ensure structural, manufacturing, and system integration constraints were met. • Generated and refined FEM mesh ensuring element quality (skewness, conformity); defined load cases and boundary conditions. • Performed linear static, modal, and crash-landing analyses; evaluated results per Drone Certification Gazette for compliance and certification readiness.

2. **Project:** Surveillance UAV for Defense (Span: 5m, MTOW: 27 kg)	• Designed lightweight composite airframe (GF skin, CF sandwich core) with focus on strength-to-weight ratio, material accessibility, and ease of manufacturing. • Performed preliminary structural sizing using SFD, BMD, and shell deformation calculations under expected mission load conditions. • Developed structural layout and guided CAD modelling to align with structural, manufacturing, and system integration requirements. • Engineered vibration-isolated camera mounting structure for high image stability and structural durability during dynamic operations. • Created high-quality FEM mesh; conducted linear static, modal, and crash-landing simulations to validate structural performance. • Built a custom spreadsheet-based PLM tool to track design iterations and enable seamless communication across the design team.

Project Associate - 1	
National Aerospace Laboratories - Bengaluru	Aug 2021 – Oct 2022
Roles and Responsibilities	
1. **Project:** Roto-Dynamic Analysis of Rotor Shaft, Small Gas Turbine (65000 rpm)	• Conducted rotor dynamic analysis to evaluate critical speeds, mode shapes, and overall stability across full-speed range. • Built rotor-bearing system models including gyroscopic effects, bearing stiffness, and mass imbalance. • Generated Campbell diagrams and critical speed maps to ensure safe operational clearance from resonance zones. • Performed unbalance response and harmonic analysis to assess vibration behaviour and fatigue risk. • Recommended design changes to shaft geometry, bearing placement, and support stiffness for improved dynamic performance. • Delivered insights to reduce vibration amplitudes, enhance rotor alignment, and ensure durability at high RPM.
2. **Project:** Design and Analysis of Fatigue Test Chamber for Air Foil Bearing	• Designed a fatigue test chamber to evaluate long-term performance of air foil bearings under cyclic loading. • Developed mechanical layout integrating air turbine (Pelton type), foil bearing housing, shaft, and containment casing. • Performed structural and thermal analysis of chamber components to ensure safety and durability under high-speed operation. • Conducted fatigue life estimation using FEA-based stress and deformation analysis. • Optimized component geometry for ease of manufacturing, assembly, and test repeatability. • Ensured robust casing design to contain high-energy rotor failures during testing.

PROJECTS / RESEARCH

Numerical Modeling and Simulation of Roller Element Bearing	
National Aerospace Laboratories - Bengaluru	Mar 2022

Project Description:

Objective:
To develop a mathematical model of roller element bearings to simulate how contact forces due to geometric faults affect bearing vibration.

Methodology:
- Bearings modelled as a spring-mass-damper system → Higher-order ODEs
- Contact forces calculated using Hertzian stress theory
- Dynamic ball positions and contact forces computed via custom algorithms
- Forces fed into the system to solve for displacement, velocity, and acceleration

Outcomes:
- Model shows ~within 5% deviation from experimental data
- Displacement, velocity, acceleration plots validated with physical references
- Model is functional and undergoing further implementation and refinement.

Tech-Stack: Euler Method for ODE Solution, Python, Object Oriented Programming.

Automated Design Workflow for Structural Analysis	
Okulo Aerospace Private Limited - Bengaluru	May 2023

Project Description:

Objective:
Develop an automated generative design workflow using Python for parametric CAD modeling, meshing, structural analysis, and result-based design optimization.

Methodology:
- Parametric CAD generated using **PythonOCC**
- Structured meshing performed via **GMSH scripting**
- Mesh data translated into **Nastran .bdf input deck**
- Analysis handled through **pyNastran API interface**
- Post-processing conducted using **ParaView scripting**
- Design evaluated, optimized, and validated in automated loop

Outcomes:
- End-to-end automation pipeline successfully created
- Integration of CAD, meshing, analysis, and post-processing achieved

Tech-Stack: Nastran, Python, Opencascade(python api), GMSH, pyNastran, Paraview

Numerical Methodology to Estimate Mechanical Properties of Woven Composite Lamina	
Okulo Aerospace Private Limited - Bengaluru	Nov 2023

Project Description:

Objective:

Develop a numerical methodology to estimate elastic properties of woven composite lamina using analytical micromechanics and homogenization principles.

Methodology:

- Unit cell mathematically modelled based on weave geometry
- Fiber/matrix volume fractions derived from geometric characteristics
- Assumed orthotropic linear elastic behaviour for lamina
- Applied **rule of mixtures**, **Halpin-Tsai**, for stiffness estimation
- Classical Laminate Theory (CLT) used to derive in-plane properties.
- Input parameters iteratively refined for accuracy

Outcomes:

- Accurate estimation of **Ex, Ey, Gxy, νxy** for woven lamina
- Analytical and numerical results show strong agreement with literature
- Fast predictive capability for early-stage composite design.
- Model applicable to varied weave types and material systems

Tech-Stack: Python OOPs, Numpy for scientific calculations, Github for composite mechanics repositories.

Detailed Simulation Methodology for Glider UAV Crash Landing on Soil	
Okulo Aerospace Private Limited - Bengaluru	May 2024

Project Description:

Objective:

To Simulate a glider UAV crash landing to estimate energy absorption and impact response on the fuselage belly during ground contact with soil.

Methodology:

- Modeled soil using **MAT_005 (Soil and Foam)** material card in LS-DYNA
- Defined soil characteristics based on **properties from published, validated literature**
- Developed detailed finite element model of the UAV fuselage belly
- Simulated gliding impact using fixed timestep integration
- Captured contact interaction (CONTACT_AUTOMATIC_NODES_TO_SURFACE) between fuselage and deformable soil surface
- Extracted deformation and stress patterns, contact forces, and energy absorption in the form of strain energy metrics

Outcomes:

- Realistic estimation of impact loads and energy dissipation during crash
- Identified structurally vulnerable zones on fuselage belly
- Informed crashworthy design modifications for lightweight UAVs
- Methodology adaptable to different soil types (yield function coefficients) and landing scenarios

Tech-Stack: LS-Dyna, Python

EDUCATION

B.Tech – Mechanical Engineering
M.S. Ramaiah University of Applied Sciences | Bengaluru | Jun 2015 – Oct 2019
Academic Project: Development of Programmable Vacuum Cleaner, **Role:** Design and Analysis of Chassis, Motor sizing and calculations.

CERTIFICATIONS

- Machine Learning Specialization | Coursera | 2022
- Supervised, Unsupervised, Recommenders, Reinforcement Learning | Coursera | 2022.
- Advanced Learning Algorithms | Coursera | 2022
- Finite Element Methods | NPTEL | 2022

RESEARCH INTEREST

- Applied Physics and Mathematical Modelling.
- Biomimetics for stress-guided additive manufacturing and mechano-chemical sensing.