

# Harish Ragul Rajaramaduraikarthik

M.E. Thermal Engineering · B.E. Aerospace Engineering · CFD & Numerical Methods Practitioner

📍 Chennai, India   ✉ harishragulkarthik@gmail.com   📞 +91 99435 06084   🌐 github.com/harishragul

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## Objective

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To join the Mechanical / Mechatronics Department at Agni College of Engineering and Technology as an Assistant Professor, bringing a **multidisciplinary** foundation that spans aerospace mechanics, thermal engineering, finite element methods, embedded systems, and computational fluid dynamics. My goal is to deliver rigorous, application-driven instruction — connecting classical engineering theory to modern numerical and digital tools — while contributing to the department's research activity through solver development and simulation-based study.

## Education

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### M.E. Thermal Engineering

2023 – 2025

*JJ College of Engineering & Technology, Anna University*

CGPA: 8.33 / 10

*Thesis: Thermal Conductivity PDE Solver using FEniCS*

- Discretised the steady-state heat conduction equation using the **finite element method** and solved it with FEniCS for spatially varying conductivity and mixed boundary conditions (Dirichlet, Neumann, Robin).
- Packaged the solver as a **Django web application** — users configure material parameters and boundary conditions through a browser interface with inline result plotting; demonstrates the link between numerical analysis and software engineering.

### B.E. Aerospace Engineering

2019 – 2023

*Dhanalakshmi Srinivasan Engineering College, Anna University*

CGPA: 8.37 / 10

*Thesis: Integration of Inertial Navigation System in a Quadcopter*

- Applied **rigid-body kinematics and Newton–Euler dynamics** to design a real-time attitude estimator fusing accelerometer and gyroscope data from an MPU-6050 IMU — directly relevant to robotics and mechatronics curricula.
- Wrote a custom **MicroPython IMU driver** for the Raspberry Pi Pico (RP2040); published on GitHub and adopted by external developers — demonstrates open-source contribution and embedded systems depth.
- Interfaced navigation output with a **Pixhawk flight controller** to close the stabilisation loop, gaining hands-on experience with actuator control and real-time systems.

## Professional Experience

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### Lead Software Developer — AI & Data Systems

Dec 2024 – May 2026

*Lumay AI Inc., USA (Remote)*

- Developed enterprise **Generative AI** solutions using LangChain and LangGraph; built **multi-agent AI** architectures with coordinated agent-to-agent orchestration.
- Implemented **Retrieval-Augmented Generation (RAG)** pipelines integrating vector databases and Neo4j for context-aware document retrieval.
- Built real-time **voice AI agents** using Pipecat with streaming LLM inference; designed LLM-powered forecasting systems using Vanna AI over PostgreSQL.

- Engineered scalable **ETL pipelines** using Prefect, Dask, and PySpark; deployed workloads on Microsoft Azure with Docker and CI/CD pipelines.
- *Teaching relevance: directly informs instruction in AI, machine learning, and modern data engineering electives.*

## Junior Software Developer — Python

Jun 2023 – Present

Telebillz Solutions LLP, Bangalore (Remote)

- Built and maintained backend services in **Django and Flask**: REST APIs, relational database design (PostgreSQL, MySQL), and payment gateway integrations.
- Developed **analytics and reporting pipelines** in Pandas and SQL running daily on production data and feeding client dashboards.
- Participated in code reviews and sprint planning — developed habits of readable, maintainable, collaborative code.
- *Teaching relevance: models professional software practice for student lab work and mini-projects.*

## CFD & Numerical Methods — Self-Directed Research

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### Incompressible Flow Solver Development

2025 – Present

Independent Study

- Implementing **incompressible Navier–Stokes solvers** step-by-step in Python: 1-D diffusion → 2-D finite difference → finite volume → projection method → SIMPLE algorithm on staggered grids.
- Learning **OpenFOAM** case setup: `blockMesh`, boundary condition files, solver selection, and ParaView post-processing.
- Next milestones:  $k-\epsilon$  and  $k-\omega$  SST turbulence models; then a conjugate heat transfer case extending the FEniCS thesis work — viable as a department-level research seed project.

## Key Projects

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### FEniCS Heat Conduction Web Solver

2024 – 2025

M.E. Thesis Project

Finite element solution of the 2-D steady-state heat equation with spatially varying conductivity and all three standard boundary condition types. Full-stack delivery: Python solver back-end with a Django front-end; results plotted inline. Demonstrates the bridge between **numerical methods** and **software engineering** — an instructive case study for students in Heat Transfer and Computational Methods courses.

### Quadcopter Inertial Navigation System

2022 – 2023

B.E. Thesis Project

Applied rotational kinematics and Newton–Euler dynamics to design a real-time attitude estimator from raw IMU data. Custom MicroPython driver for the RP2040 microcontroller — demonstrates **microcontroller programming**, **sensor integration**, and open-source contribution. A natural teaching artefact for Mechatronics, Robotics, and Embedded Systems labs.

## Technical Skills

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**Numerical Methods:** FEM (FEniCS), finite difference, finite volume, SIMPLE algorithm, projection method

**CFD / Simulation:** OpenFOAM (learning), ParaView, Python-based solver development

**Mechanics & Dynamics:** Rigid-body kinematics, Newton–Euler dynamics, sensor fusion, inertial navigation

**Embedded Systems:** Raspberry Pi Pico (RP2040), MicroPython, MPU-6050 IMU, I<sup>2</sup>C protocol, Pixhawk

**Generative AI & LLMs:** LangChain, LangGraph, RAG, vector databases, Neo4j, prompt engineering

**Data Engineering:** PySpark, Prefect, Dask, ETL design, PostgreSQL, MySQL

**Programming:** Python (advanced), Django, Flask, Pandas, SQL, C/C++ (basic), Git

**Cloud & DevOps:** Microsoft Azure, Docker, CI/CD pipelines, REST APIs, gRPC

**Learning / Exploring:** SolidWorks (basic), Arduino ecosystem, 3-D printing principles

## Courses Able to Teach

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- Engineering Mathematics (ODEs, PDEs, Linear Algebra)
- Thermodynamics & Heat Transfer
- Fluid Mechanics & CFD
- Numerical Methods in Engineering
- Mechanics of Machinery / Kinematics
- Robotics & Mechatronics
- Embedded Systems & Microcontrollers
- Sensors, Transducers & Instrumentation
- Control Systems
- Machine Learning for Engineers (elective)
- Python / Scientific Computing Lab
- AI & Generative Systems (elective)

## Alignment with Mechanical / Mechatronics Department

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Department Need	My Background
<b>Mechanics &amp; Kinematics</b>	Quadcopter thesis: rotational kinematics, Newton–Euler dynamics, stabilisation loop design
<b>Thermal &amp; Heat Transfer</b>	M.E. specialisation in Thermal Engineering; FEM-based heat conduction solver with Dirichlet, Neumann and Robin BCs
<b>CFD &amp; Simulation</b>	Ongoing Navier–Stokes solver development in Python; OpenFOAM case setup; FEniCS expertise
<b>Embedded &amp; Microcontrollers</b>	RP2040 programmed in MicroPython; MPU-6050 over I <sup>2</sup> C; Pixhawk integration; GitHub-published IMU driver
<b>Research Potential</b>	Two independent thesis projects; systematic self-study programme in CFD; AI/ML development experience
<b>Software &amp; Computing Lab</b>	2+ years professional Python development; full-stack Django web apps; production data pipelines
<b>Modern AI Electives</b>	Lead AI developer at Lumay AI: LLMs, RAG pipelines, multi-agent systems, real-time voice AI

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