

# Kanak Agarwal

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## EDUCATION

### INDIAN INSTITUTE OF TECHNOLOGY, MADRAS | M.Tech

2025 - Present | Chennai, India

- Computational Engineering, Computational Fluid Dynamics Stream
- Research Assistant at the Department of Aerospace Engineering, IITM.
- Awarded a fully-funded scholarship for the duration of the program.

### MANIPAL INSTITUTE OF TECHNOLOGY | B.Tech

2021 - 2025 | Manipal, India

- Major in Aeronautical Engineering, Minor Specialization in Aerodynamics
- CGPA: 8.56/10.00

### LALAJI MEMORIAL OMEGA INTERNATIONAL SCHOOL | Class 12 (CBSE)

2021 | Chennai, India

- Major in Computer Science
- Grade: 91.20%

## RESEARCH INTERESTS

- Computational Fluid Dynamics (CFD)
- Aerodynamics
- Machine Learning/ Data-Driven Modelling
- High Performance Computing (HPC)
- Turbulent Flows
- Vorticity Dynamics

## PUBLICATIONS

- Praveen Kumar, V., **Agarwal, K.**, Sameen, A., and Thara Reshma, I. V., "Flow Regimes in the Evolution of a Hot Buoyant Vortex Dipole," Physics of Fluids, Vol. 36, No. 12, 2024, p. 123633. <https://doi.org/10.1063/5.0244160>
- Suhas, K. S., Krishna, R., **Agarwal, K.** and Murugaiah, M., "A MATLAB GUI-Based Approach to Wing Design and Aerodynamic Performance Evaluation", AIP Conference Proceedings [Accepted]
- **Agarwal, K.**, Vijaykrishnan, V., Mohanty, D., and Murugaiah, M., "A Comprehensive Dataset of the Aerodynamic and Geometric Coefficients of Airfoils in the Public Domain", Data, Vol. 9, No. 5, 2024, p. 64. <https://doi.org/10.3390/data9050064>

## CONFERENCES

- MATLAB-Enhanced Wing Design and Aerodynamic Modeling, Symposium on Applied Aerodynamics and Design of Aerospace Vehicles (SAROD), Thiruvananthapuram, India, Dec 2024. [Poster Presentation]
- A MATLAB GUI-Based Approach to Wing Design and Performance Evaluation, International Conference on Futuristic Advances in Mechatronics Engineering (ICFAMEAD), Pune, India, Oct 2024. [Oral Presentation]

## RESEARCH EXPERIENCE

### BUOYANT VORTEX DIPOLES & RINGS

Dec 2023 - Present | Chennai, India

- Studying the temporal evolution of Buoyant Vortex Dipoles & Rings at the Theoretical and Computational Fluid Dynamics Laboratory (TCFD) at the Department of Aerospace Engineering, Indian Institute of Technology (IIT), Madras, India, under the guidance of Dr. A Sameen.
- Derived the governing equations in the non-dimensional form under the Oberbeck-Boussinesq approximation and implemented them using pseudo-spectral methods in Dedalus, an open-source Python-based framework.
- Integrating data-driven analysis techniques with direct numerical simulation (DNS).

## **DATASET OF AIRFOIL COEFFICIENTS**

Jul 2022 - Apr 2024 | Manipal, India

- Developed a robust, automated, and scalable CFD framework under the guidance of Dr. Manikandan Murugiah at the Manipal Institute of Technology, Manipal, India.
- Generated a dataset of aerodynamic and geometric coefficients of 2900 airfoils in the public domain using OpenFOAM, Shell Scripting, and MATLAB.
- Achieved a 21X speedup using the process-parallelized approach and custom Bash scripts.

## **MATLAB-ENHANCED WING DESIGN**

Dec 2023 - Feb 2024 | Manipal, India

- Developed a MATLAB-based framework and GUI application for the efficient design of intricate wing surfaces under the guidance of Dr. Manikandan Murugiah at the Manipal Institute of Technology, Manipal, India.
- Automated the creation of '.stl' files for wings of various dimensions, allowing for the integration of customizable geometrical features such as twist, taper, dihedral, and sweep.
- Added support for multiple NACA airfoil series, extending it to both the CST and PARSEC parameterization methods.

## **ACHIEVEMENTS**

### **ICFAMEAD 2024**

Oct 2024 | Pune, India

- Awarded best paper out of 40 papers in the Design Engineering Track at the International Conference on Futuristic Advances in Mechatronics Engineering for Aerospace and Defence (ICFAMEAD) 2024.

### **NACDEC VII**

Aug 2023 | Bangalore, India

- Achieved 2<sup>nd</sup> position out of 45 teams in the National Aerospace Conceptual Design Competition (NACDeC) organised in collaboration with the Indian Space Research Organisation (ISRO).

### **ICCMEH 2023**

Aug 2023 | Manipal, India

- Achieved 3<sup>rd</sup> rank for our submission to the CFD competition held as a part of the International Conference on Computational Methods on Engineering & Health Sciences (ICCMEH) 2023.

### **SAE AERO DESIGN**

Mar 2023 | Lakeland, USA

- Achieved 2<sup>nd</sup> place in the design report category and 4<sup>th</sup> overall in the micro class of the SAE Aero Design East 2023 held at Lakeland, Florida, USA.

### **PAPER PRESENTATION**

Dec 2022 | Manipal, India

- Awarded the 1<sup>st</sup> prize in the Paper Presentation event as part of the Tech Tatva '22.
- Presented a research paper on the viability of Methane as a fuel for liquid rocket engines.

## **SKILLS**

### **TECHNICAL**

- |          |            |                |                   |                    |
|----------|------------|----------------|-------------------|--------------------|
| • C      | • OpenFOAM | • Solidworks   | • Tecplot360      | • FORTRAN          |
| • Python | • ParaView | • Fusion360    | • PBS/TORQUE      | • Docker/Apptainer |
| • MATLAB | • Ansys    | • AutoCAD      | • Slurm           | • Photoshop        |
| • LaTeX  | • COMSOL   | • CATIA        | • Git & GitHub    | • Illustrator      |
| • HTML   | • XFLR5    | • 3DEXPERIENCE | • XMGrace         | • Lightroom        |
| • XML    | • XFOIL    | • OpenVSP      | • Shell Scripting | • Canva            |
| • MySQL  | • Linux    | • Simulink     | • OpenMPI         | • Microsoft Office |

### **OTHER**

- Expert communication and presentation skills.

## OTHER EXPERIENCE

### NACDEC VII

Sep 2023 - Sep 2024 | Manipal, India

- Achieved 2<sup>nd</sup> position out of 45 teams in the National Aerospace Conceptual Design Competition (NACDeC) organized in collaboration with the Indian Space Research Organisation (ISRO).
- Conducted an extensive literature review and developed Martian Solar Irradiance and Reference Atmosphere models.
- Designed and developed a 70kg solar-powered UAV for the study of the Martian Planetary Boundary Layer (0-100 m), capable of performing 20 sorties in a sol.

### RESEARCH SOCIETY MIT | Co-Expertise Head

Jun 2022 - Sep 2024 | Manipal, India

- Led the aerospace, aeronautics, and material sciences domains as the co-expertise head during the AY 2023-24.
- Conducted a comprehensive taskphase to introduce the new members to the domain and various topics of potential research.

### IE AEROSPACE | Advisory Board Member

Dec 2021 - Sep 2024 | Manipal, India

- Contributed to the day-to-day operation of the club as an advisory board member during the AY 2023-24.
- Designed graphics for social media handles, conducted multiple technical and non-technical events, and hosted several guest lectures.

### CFD COMPETITION (ICCMEH 2023)

Jul 2023 - Aug 2023 | Manipal, India

- Achieved 3<sup>rd</sup> place in the CFD competition held on the sidelines of the International Conference on Computational Methods on Engineering & Health Sciences (ICCMEH 2023).
- Optimized the NACA 4412 airfoil for the specified operating conditions.
- Implemented a genetic algorithm using the CST coefficients coupled with XFOIL in MATLAB.
- Conducted a parametric sweep analysis in Ansys Fluent to validate the results obtained.

### MANO AIRCRAFT PRIVATE LIMITED | Intern

Jun 2023 | Coimbatore, India

- Learnt and applied several composite manufacturing techniques.
- Manufactured high-quality carbon fiber composite parts.
- Developed a Python script to automate the pre-composite manufacturing processes.
- Conducted a market survey as part of a market analysis.

### AEROMIT | Junior Aerodynamics Engineer

Dec 2021 - Apr 2023 | Manipal, India

- Created detailed technical documentation for the design and construction of various RC aircraft.
- Designed RC aircraft adhering to mission requirements based on fundamental aerodynamic principles.
- Achieved 2<sup>nd</sup> in the design report category and 4<sup>th</sup> overall in the micro class of the SAE Aero Design East 2023 held at Lakeland, USA.