

# AKASHDEEP SINGH

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## EDUCATION

### Indian Institute of Technology Kharagpur

Bachelor of Technology (Hons.) in Aerospace Engineering [CGPA: 8.81/10]

Kharagpur, India

July '19 – Present

### Higher Secondary Education

Central Board of Secondary Education – 94.4%

Navy Children School Kochi, India

July '17 – May '19

### Secondary Education

Central Board of Secondary Education – CGPA: 10/10

Kendriya Vidyalaya Karwar

May '17

## RESEARCH INTERESTS

Experimental Fluid Dynamics, Bio-Inspired Flow, Turbulence Modelling, Multiphase Flow, Atmospheric & Geophysical Flow

## TECHNICAL SKILLS

**Languages:** C, C++, Python(NumPy, OpenCV), MATLAB, GNU Octave, LaTeX

**Softwares:** SOLIDWORKS, Ansys(Fluent & Structural), MATLAB/Simulink, AutoCAD, Simscape, OpenVSP, APP-6.0, LTspice

**Experimental:** Hot-Wire Anemometry, Machining & Welding, Water Tunnel Operation & Pressure Measurements

## PROFESSIONAL EXPERIENCE

### Spray Analysis and Turbulence Characterisation in a Canonical AtomizerLEGI, Université Grenoble Alpes, France

Summer Research Intern | Supervisor: **Dr. Nathanael Machicoane** | [Certificate]

May '22 - Jul '22

- Studied about **gas-assisted liquid jets** influenced by **gas swirl** and **helical instabilities** and attended live seminars
- Produced liquid probability plots to estimate the **near-field spray angle** and **virtual origin** by fitting **gaussian distributions**
- Performed **Hot-Wire Experiments** for gas flow rates from **Re 13000** to **110000** for 3 distinct acquisition frequencies
- Inspected multiphase flow parameters like momentum flux ratio to scale spray angle using **power law dependence**
- Estimated **turbulence length scales, dissipation rate, and energy spectra** from velocity time series for **gas Re up to 400**

### Aerodynamic Design of an Expendable UAV

ADE, DRDO, Bangalore, India

Summer Intern | Supervisor: **Dr. Bhavneet Kaur (Scientist - E)** | [Certificate]

Jul '21 - Aug '21

- Conducted a **market survey** of over **10** existing UAVs and compiled information on flight performance & powerplant
- Generated the **CAD model** of an initial UAV configuration from its 3-view drawing using **OpenVSP Geom Browser**
- Validated a **Vortex-Lattice solver** by plotting the variation of aerodynamic coefficients with angle of attack and sideslip angle
- Implemented a **Low-Fidelity analysis** on the UAV for multiple wing/airfoil geometries, gaining max. increment of **36%** in  $C_L$
- Evaluated the **flight envelopes** for different geometries and iteratively revised the configuration based on **range** and  $L/D$

## PROJECTS

### Chassis Development | TeamKART - Formula SAE | [Website]

IIT Kharagpur

Supervisor: **Dr. Dhananjay Kumar Srivastava** | Mechanical Engineering Department | [Certificate]

Jul '19 – Present

- Modelled a spaceframe chassis with a torsional stiffness of **1800 Nm/deg** and **7mm** deflection in case of a head-on crash
- Designed mounts and computed stress contours considering FSAE rules for safe integration of other components to chassis
- Built a customized mild steel-based fixture to manufacture the chassis in a **triangulated** and orderly manner
- Developed a jig setup for experimentally analyzing the torsional stiffness of chassis, including **flanges**, and **I-beams**
- Planned and managed the procurement of components from vendors across India, and got hands-on experience in machining

### Aerodynamics of Tandem Flapping Wings | BIAHL | [Website]

IIT Kharagpur

Undergraduate Researcher | Supervisor: **Dr. Sunil Manohar Dash** | Aerospace Engineering Department

Sept '21 - Present

- Reviewed over **40** research papers on bio-inspired flow and flapping wing aerodynamics for the design of MAVs and UUWVs
- Analyzed **overset** and standard dynamic grids to finalize and adopt the optimum grid type for simulations
- Constructed 4 sets of dynamic grids for flapping foil simulations and carried out grid convergence with **max 2.38% error**
- Simulated tandem flapping wings on a supercomputer for 6 values of  $St$  to model thrust variation with frequency
- Currently investigating the effect of the wing pivot points and high  $St$  ( $> 0.7$ ) on vortex interactions and propulsive efficiency

## Design of a Small-Scale ShockTube | Aerodynamics Laboratory

IIT Kharagpur

Supervisor: *Dr. Sandeep Saha* | Aerospace Engineering Department | *[Final Presentation]*

Aug '21 - Nov '21

- Built a small-scale steel shocktube with 4 layers of aluminium foil as diaphragm, and driven-to-driver section **length ratio 2.3**
- Measured the dynamic and kinematic effects by a shock on different geometries attached to a spring-damper system
- Assessed the structural strength of shocktube and supporting mounts at **4 bar maximum differential pressure** on Simscale
- Experimented to observe the effect of outgoing shockwaves from the shocktube on a water lamina flowing downhill
- Designed a Schlieren imaging setup design for visualization of shocks and their interaction with water lamina

## Design of a 2D FishTail Propulsor | Propulsion Laboratory

IIT Kharagpur

Supervisor: *Dr. Srinibas Karmakar* | Aerospace Engineering Department | *[Final Presentation]*

Jan '22 - Apr '22

- Studied about a wide range of fishtail motions categorized in terms of oscillating frequency, wake formation, and thrust
- Simulated fish body-tail system modeled as airfoils on Ansys, for different Strouhal numbers and angular amplitudes
- Designed a gear mechanism for the fishtail and mathematically derived the equations of motion
- Created a **Simulink model** based on the equations of motion and force profiles and recorded a thrust of up to **7 N** for **St 0.37**
- Manufactured a water tank using perspex and assembled an **Arduino-controlled fishtail** model for experimental analysis

## COMPETITIONS

### Formula Bharat Virtuals 2021-22

Formula Bharat

*[Link]* | *[Design Presentation]*

Apr '21 - Sept '21

- Won the **Formula Bharat Virtuals' 2021** by securing an **overall 1st place** among **31** participating teams at the national level
- Secured **1st place** in **Engineering Design Event** and received the **"Best Powertrain Package"** award
- Secured **11th place** in the **Business Plan Presentation Event**

## HONOURS & AWARDS

### Charpak Lab Scholarship, 2022

Embassy of France in India

*[Certificate]*

Mar '22

- Selected for the prestigious **Charpak Lab Scholarship** awarded to **(20 – 30 out of ~1000)** applicants from all over India to undertake a research internship at a Laboratory in France

### Boeing India Mentorship Programme

Boeing, India

*[Certificate]*

Date '21

- Selected for the **Boeing-IIT Kharagpur Joint Mentorship Programme**, to carry out a year-long mentorship program under the guidance of a Boeing mentor and gain exposure to career aspects in the aerospace industry

## COURSEWORK

- **Aerospace:** Aerodynamics (Low Speed, High Speed, Unsteady), Flight Stability & Controls, Flight Mechanics, Structural Dynamics, Thermodynamics & Aerospace Propulsion, Aircraft Design
- **Fluid Mechanics:** Physics of Fluid Flow Experiments, CFD, Atmospheric Flow, Turbulence, Viscous Flow
- **Mathematics:** Linear Algebra, Probability & Statistics, Numerical Solutions to ODE & PDE, Transform Calculus,
- **Miscellaneous:** Basic Electronics, Science & Humanism, International Business
- **MOOC:** Machine Learning (Stanford University, Coursera), Deep Learning (DeepLearning.AI, Coursera), MATLAB Onramp

## POSITIONS OF RESPONSIBILITY

### Head of Chassis Subsystem | TeamKART - Formula SAE

Formula Bharat

*[Certificate]*

Jul '19 – Present

- Responsible for the **procurement** of components and management of finances to manufacture chassis and overall vehicle
- Involved in the mentoring of **48** first-year students and **5** second-year students to ensure smooth functioning of the team
- Managed to reduce the cost of the vehicle by **INR 16000** by engineering customized components for the chassis

### Student Mentor | Student Welfare Group

IIT Kharagpur

*[Certificate]*

Nov '21 - Present

- Volunteered to guide **5** first-year students of Aerospace Engineering and help them transition from school to college smoothly

## EXTRA CURRICULAR ACTIVITIES

- Represented my residence in the badminton general championship held by Technology Students Gymkhana, IIT Kharagpur
- Participated in inter-school public speaking and elocution competition and won second prize