

ANUBHAV DEY

Email: dey24@purdue.edu

Phone: +1 765 694 5406

Address: 585 Purdue Mall, West Lafayette, IN 47907

EDUCATION

Purdue University, West Lafayette, India	PhD Mechanical Engineering, GPA: 3.95/4	2028 (Expected)
Jadavpur University, Kolkata, India	B.E. Mechanical Engineering, GPA: 9.34/10	2023

RESEARCH INTERESTS

Fluid Mechanics, Particle Diffusion, Particle Image Velocimetry, Unsupervised Machine Learning, Image Processing, Signal Processing, Physical modelling.

RESEARCH EXPERIENCE

School of Mechanical Engineering, Purdue University
Graduate Research Assistant, Advisor: **Prof. Pavlos Vlachos** West Lafayette, USA
(October 2023-Present)

- **High-Fidelity Dynamic Light Scattering (DLS) Model.**
 - Surveying DLS models available in literature and identifying the gaps.
 - Modelling physical processes in the measurement chain.
 - Comparison with commercial DLS systems shows < 2 % errors.

School of Mechanical Engineering, Purdue University
Graduate Research Assistant, Advisor: **Prof. Pavlos Vlachos** West Lafayette, USA
(January 2023-Present)

- **Image processing and regression methods for Image-based Probability Estimation of Displacements .**
 - Developed multispectral methods to improve performance in noisy environments, and enabling multiple particle sizing.
 - Identified cause of bias error due to image noise, and developed regression based methods to correct for this bias and obtain size distribution.
 - Results showed 82 % reduction in bias error for 40% noise and size distribution results were within 6%.

School of Mechanical Engineering, Purdue University
Graduate Research Assistant, Advisor: **Prof. Pavlos Vlachos** West Lafayette, USA
(January 2023-Present)

- **Multi-Peak Cross-Correlation Particle Image Velocimetry Using Generalized Linear Regression with RBF Kernel**
 - Developed regression techniques to learn the multiple displacements and corresponding particle sizes that may exist in the PIV window.
 - Monte Carlo results show Mean absolute errors of 0.11 pixels for x and y displacements demonstrating the accuracy of the method

Mechanical Engineering Department, Jadavpur University
Undergraduate Researcher, under the guidance of **Prof. Sandip Sarkar** Kolkata, India
(August 2022-August 2023)

- **Study of vorticity due to fluid structure interaction of cylindrical bluff body with pitching flaps using computational fluid dynamics.**
 - Ran the simulation using an in house CFD solver based on the **immersed boundary method**, utilising **parallel computing** on a high-performance computer.
 - Obtained the **vorticity characteristics** for flapping Strouhal number values of 1 and 2 and Reynolds number of 250.
 - The phase angles between pitching plates were set at 30° and 45°.

- Plotting the **vorticity contours** and quantifying the **separation angle** for the wake structure.

Mechanical Engineering Department, IIT Madras

Undergraduate Researcher, under the guidance of **Prof. N. R. Vadlamani**

(May 2022-Sept' 2022)

- **CFD study on the effect of bio-inspired sharkskin features on the Aerodynamic performance of wings.**
 - Analysing data obtained from CFD simulation for **3D span averaged zero pressure gradient flow over a flat plate**.
 - The solver used explicit 4th order Runge-Kutta time integration, and the immersed boundary method for computational mesh.
 - Using **Power Spectral Density** plots, for the frequency data of velocity fluctuations, to find velocity frequency pulses which give the dominant frequencies.
 - Obtained **Scalogram plots** for the Strouhal number.
 - Studying the effect of free stream turbulence and roughness element on the transition to turbulence by **plotting skin friction coefficient** against the x-coordinate in streamwise direction.

School of Engineering, University of Guelph

Guelph, ON, Canada

Summer Intern, under the guidance of **Prof. William Lubitz**

(May 2022-August 2022)

- **Investigating Heat Exchange Processes in Greenhouses**
 - Analysing the heat transfer from greenhouse glazing, plant surfaces and the soil surface by convection, between soil layers by conduction, and from the sky by radiation.
 - **Calibrating thermocouples and anemometers** for recording temperature and windspeed data from the greenhouse.
 - Determining the **Supplemental Heating and Cooling requirements** for greenhouses for the varying climates of Canadian provinces.

Mechanical Engineering Department, Purdue University

Undergraduate Researcher, under the guidance of **Prof. Pavlos Vlachos**

(Sept' 2021- August 2022)

- **Unsupervised Detection of Bubbles in Multiphase Flows and quantifying the gas content.**
 - **Generating synthetic bubble images** using a normal distribution intensity profile, and particle images to verify the segmentation algorithm.
 - Performing a **thresholding** and **connected components** based bubble and particle segmentation.
 - **Extracting features** for bubbles and particles like Intensity, radius and circularity, and ranking them based on the **Kullback-Leibler divergence**.
 - The **Kmeans clustering method** was run on these features and used to cluster the bubbles and particles separately.
 - This algorithm will later be used to work on **real PIV images** to **detect bubbles** and their associated **properties**.

PUBLICATIONS

1. Title: Regression methods for Image-based Probability Estimation of Displacements and its applications to finding Nanoparticle Size Distributions and Noise Induced Error Reduction (In preparation)
Authors: Anubhav Dey, Pavlos Vlachos
2. Title: Multi-Peak Cross-Correlation Particle Image Velocimetry Using Generalized Linear Regression with RBF Kernel. (In preparation)
Authors: Anubhav Dey, Pavlos Vlachos
3. High-Fidelity Dynamic Light Scattering Model. (In preparation)
Authors: Anubhav Dey, Pavlos Vlachos

TECHNICAL SKILLS

- Programming Software: Python, MATLAB, C, Java