Vatsal Sanjay

Thermal Engineering, Senior Year

Department of Mechanical Engineering, IIT Roorkee
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Seeking doctorate position to continue the quest in the world of coupled multi-phase flows and fire dynamics

Areas of Interest

Two-phase flow and heat transfer, Computational multi-fluid Dynamics and interface reconstruction, Fire Dynamics, Multi-scale physics

Fields of Interest

Liquid jets and their interactions, Fire propagation and flame tracking, Dynamics of droplets, bubbles and liquid sheets

Education

Undergraduate

2013 — **Integrated Dual Degree: B.Tech (Mechanical Engineering) and M.Tech (Thermal Engineering)**, *Indian Institute of Technology, Roorkee*, Uttrakhand, India.

Thesis: Understanding of mutual interactions between liquid jets: entrainment and sheet formation.

CGPA: 8.977 on a scale of 10

High School

2013 — **Twelfth, AISSCE**, *CBSE, Jesus and Mary Academy*, Darbhanga, Bihar, India.
Graduated with *96.4%* marks

2011 — **Tenth, AISSE**, *CBSE, DAV Public School*, MTPS, Muzaffarpur, Bihar, India.
CGPA: 10 on a scale of 10

Research Experience

August, 2014 - Present — Two-phase and micro-fluidics group, Indian Institute of Technology, Roorkee, India.
Mentor: A/Prof. Arup Kumar Das

Working on
- Sheet dynamics.
- Multiscale simulations.
- Jets, Drops and Bubbles.
- Fire Dynamics.
- Phase change heat transfer.

May, 2016 - July, 2016 — Laboratoire de Mécanique des Fluides et d'Acoustique - UMR 5509, Université Claude Bernard Lyon1, France.

Mentors: A/Prof. J. John Soundar, Prof. Jean-Philippe Matas, Prof. Mickaël Bourgoin

Worked on
- Landau-Levich film entrainment.
- Rotary Entrainment.

Skills

Computational Fluid Dynamics Packages

Gerris, Gerris-Particle, Paris Simulator, OpenFOAM, Fire Dynamics Simulator, FLUENT, Basilisk C

Computer Languages

C++, C, MATLAB

Lab Based Software Packages

LabView: Voltage module, Worked with Conductivity and Optical Probe, Image Analysis

Others

Octave, LaTeX, SolidWorks, AutoCAD

Research Involvements

2016 **Collision of liquid jets**.

Mentor Prof. Arup Kumar Das

Description Numerical simulations are used to understand the fundamental Physics for different regimes observed as a result of collision of two liquid jets. Experiments are also conducted to explore the asymetries induced in the process and to fomulate the numerical model for simulations.

2015 **Bubble Entrainment by plunging liquid jets on pool**.

Metor Prof. Arup Kumar Das

Description A series of controlled experiments and numerical simulations is carried out to delve into the process of bubble entrainment by plunging liquid jet. The initiation process is captured. Entrainment clusters obtained are throughly characterized and their interactions in case of multiple jet impinging onto the pool are studied.

2015 **Multi-Scale Simulation**.

Mentor Prof. Arup Kumar Das

Description Volume of Fluid (VOF) - Lagrangian Point Particle (LPP) based hybrid approach is used to study diffrent multi-scale phenomena, such as liquid jet atomization, bursting of bubble at the liquid pool surface and transition of two phase pipe flow from annular to droplet flow regime.

2015 **Numerical Simulation of Drainage of Kitchen Sink**.

Mentor Prof. Arup Kumar Das

Description Three dimensional simulation of emptying of the kitchen sink is carried out to observe the vortex-like structures formed during the drainage. Dependence of the structures formed on fluid properties and geometry and placement of the drain is explored.

2015 **Numerical Simulation of phase change processes**.

Mentor Prof. Arup Kumar Das

Description A coupled Volume of Fluid (VOF) - Phase change module is used to simulate the boiling process over a series of cylinders arranged in different configurations, such as vertical and horizontal inline, and staggered.

2016 **Numerical Investigation of the Landau film entrainment**.
2016

Mentors Prof. J. John Soundar, Prof. Jean-Philippe Matas, Prof. Mickaël Bourgoin

Description The classical Landau film problem of the coating of a plate with liquid as the plate is dragged out of the liquid pool has been studied under this project. The model is first validated with Landau's expression for steady state film thickness, and then is used to characterize the overlap region between the film and the meniscus near the pool.

2016 **Numerical Investigation of Splashing from a Rotating Body**.
2016

Mentors Prof. J. John Soundar, Prof. Jean-Philippe Matas, Prof. Mickaël Bourgoin

Description The aim of this project is to predict water dispersion around the wheel of a car crossing a ford. We have used a finite volume based computational multi-fluid dynamics solver, Gerris to investigate the phenomenon numerically.

2014 **Fire Dynamics**.

Mentor Prof. Arup Kumar Das

Description The main aim of this project is the simulation of different fire scenarios, such as compartment fires and forest fires. Fire Dynamics Simulator (FDS) is used to study the propagation of fires and smoke flow pattern in enclosures such as buildings and railway coaches. Modelling of forest is done using obstructions of various sizes, subjected to fire. Scaled down experimental setup is also used to visualize the process.

Journal Publications

2017 **Vatsal Sanjay and Arup Kumar Das. "On air entrainment in a water pool by impingement of a jet". In: *AIChE Journal*. ISSN: 1547-5905. DOI: 10.1002/aic.15828.**

2017 **Vatsal Sanjay and Arup Kumar Das. "Liquid Chain Genesis by Collision of Two Laminar Jets". In: *Physics of Fluids (Under Review)*.**

2017 **Vatsal Sanjay and Arup Kumar Das. "Liquid Chain Genesis by Collision of Two Laminar Jets". In: *Under Review*.**

2017 **Vatsal Sanjay and Arup Kumar Das. "Liquid Chain Genesis by Collision of Two Laminar Jets". In: *Under Review*.**

2017 **Vatsal Sanjay and Arup Kumar Das. "Liquid Chain Genesis by Collision of Two Laminar Jets". In: *Under Review*.**

2017 **Vatsal Sanjay and Arup Kumar Das. "Numerical Assessment of Hazard in Compartmental Fire Having Steady Heat Release Rate from the Source". In: *Building Simulation*.**

Achievements

- Secured rank of 2988 in Graduate Aptitute Test in Engineering among 190648 candidates.
- Received Summer Undergraduate Research Award (SURA) in summers of 2015 at IIT Roorkee
- Cleared IIT-JEE Advance with All India rank 1512 (in top 1% of the total appearing students) and JEE Mains with All India rank 765 and state rank 11.

Languages

English **Fluent** *Daily practice, all work performed in English*

Hindi **Native** *Mother Tongue*

Extra-Curricular

Academic Reinforcement Program

2015 – 2017 **Tutor**.

- Worked to instill academic zeal.
- Deliver lectures on Mathematics - 101 and Mechanics for the freshmen batch.

Student Mentorship Program

2016 – 2017

Mentor.

- Guided junior batch students.

Mechanical & Industrial Engineering Students' Society

2014 – 2016

Joint Secretary.

- Conducted lectures on skill based attributes, like Introduction to MATLAB.
- Conducted several events to increase inter-year interaction among the students.

National Service Scheme

2013 – 2014

Volunteer.

Main Duties:

- Worked in the Awareness Cell of NSS - IIT Roorkee.
- Participation in street plays on campus and villages nearby for awareness on socio-political issues.
- Participation in paper presentation in nearby villages.

References

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