Atharva Sunil Sathe

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Education

Columbia University in the city of New York Jan 2021 - Present
Doctor of Philosophy in Civil Engineering & Engineering Mechanics (GPA: 3.87 / 4.00) *New York, NY*
Specialties: Environmental Fluid Mechanics, Urban Climate, Turbulence Modeling, High Performance Computing

Indian Institute of Technology Bombay July 2015 - Aug 2020
Bachelor-cum-Master of Technology (Dual Degree) in Aerospace Engineering (GPA: 9.39 / 10.00) *Mumbai, MH*
Specialties: Computational Fluid Dynamics, Numerical Modeling, High Performance Computing

Scholastic Achievements

- Awarded **Institute Silver Medal** at 58th Convocation, IIT Bombay 2020
- **Ranked 1st** in the Dual Degree batch of the Aerospace Engineering Department.
- Awarded the prestigious **NTU-India connect program scholarship** for academic excellence. 2018
- Earned the **Institute Academic Award** for exceptional academic performance. 2017
- Received **Teaching Assistant Excellence Award** for outstanding student mentorship in Dynamics & Vib. course. 2023
- Received **Teaching Assistant Excellence Award** for outstanding student mentorship in Fluid Mechanics course. 2022
- Secured a **top 0.71%** percentile in JEE (Advanced) and a **top 0.14%** percentile in JEE (Main). 2015
- Qualified for the Indian National Chemistry Olympiad, placing within the **top 1%** of participants nationwide. 2015

Research Experience

Columbia University Jan 2021 – Present
Graduate Researcher, Environmental Flow Physics Lab *New York, NY*

- Conducted a comprehensive analysis of domain size impacts in canopy flow simulations, demonstrating how inadequate sizing compromises turbulent structures and flow statistics.
- Identified significant flaws in conventional scale separation testing method. Developed a novel, superior alternative for accurate isolation of scale separation effects.
- Discovered a critical interplay between canopy element arrangement and the existence of inertial sublayer in the atmosphere, challenging the previous understanding that scale separation was the sole factor.
- Investigated the important parameters influencing the structure of secondary circulations within urban canopies.
- Made a key discovery: Aerodynamic roughness length plays a major role in determining the polarity and strength of secondary flows, significantly impacting advection-induced dynamics.
- Leveraging the knowledge of secondary flows to strategically induce them within wind turbine arrays, aiming for increased efficiency by aligning the turbines with high-momentum pathways.

Indian Institute of Technology Bombay July 2015 – Aug 2020
Undergraduate and Graduate Researcher *Mumbai, MH*

Master Thesis Project:

- Developed a novel multidimensional extension of the Large Time-Step (LTS) method using the Radon Transform's intertwining property, addressing errors common in dimensional splitting.
- Validated the algorithm for electromagnetic wave propagation, achieving a remarkable 14x speedup while simultaneously reducing error by a factor of 4.
- Proved the effectiveness of the first-order Mur absorption boundary condition within this approach, demonstrating its ability to minimize reflections.

Bachelor Thesis Project:

- Contributed to the development of arcFOAM, a magnetohydrodynamic solver built upon sonicFOAM with the addition of essential source terms in the momentum and enthalpy conservation equations.
- Validated arcFOAM against both the analytical solution for current flow in an infinite rod and by replicating results from the 2D transferred arc geometry presented in Sass-Tissovskaya thesis.
- Employed arcFOAM to investigate flow properties in arc heaters, simulating various arc lengths (4mm, 10mm, 20mm) to gain comprehensive insights.

Nanyang Technological University May 2018 – July 2018
Summer Research Intern – NTU-India Connect Program *Singapore, SG*

- Conceptualized and executed a project investigating the effect of swirling flow on average heat transfer coefficients, recognizing its potential for turbulence and velocity gradient enhancement.
- Established a baseline by validating a straight-flow simulation, carefully evaluating the influence of different turbulence models.
- Introduced a weak, constant axisymmetric swirl into the designated geometry, demonstrating its positive impact on microscale heat transfer and validating the project's hypothesis.

Peer Reviewed Journal and Conference Publications

- **Sathe, A.S.** and Giometto, M.G. (2024) 'Impact of the numerical domain on turbulent flow statistics: scalings and considerations for canopy flows', Journal of Fluid Mechanics, 979, p. A36. doi:10.1017/jfm.2023.1041.
- **Sathe A.S.**, Li, W., Giometto, M.G. (2024) 'Impact of the aerodynamic roughness length on polarity of roughness-induced secondary flows', Physical Review Fluids *(under preparation)*
- **Sathe, A.S.**, Makwana, N., Chatterjee, A., Pillai, H. (2020) 'FVTD Large Time-Step Method Using Radon Transform', IEEE International Conference on Computational Electromagnetics, Singapore, 25-27 March.

Selected Conference Presentations

- **Sathe A.S.,** Giometto M.G., Impact of numerical domain on turbulent flow statistics: scalings and considerations for canopy flows. In APS DFD Meeting, November 2023, Washington, DC.
- **Sathe A.S.,** Giometto M.G., Impact of numerical domain on turbulent flow statistics: scalings and considerations for canopy flows. In AGU Fall Meeting, December 2022, Chicago, IL.

Technical Skills

Softwares: MATLAB, ANSYS, OpenFOAM, Gmsh, Maple, Solidworks, AutoCAD
Programming: Python, FORTRAN, C++, C, CUDA, OpenGL

Extracurricular Activities

Institute Student Mentor — Student Mentor Program, IIT Bombay July 2017 - May 2020

- Selected as the only third-year B.Tech student among a 900+ cohort after a rigorous interview, ethical assessment, and peer review to serve in this high-responsibility role.
- Successfully mentored 22 freshmen in two years, providing guidance and support to ease their academic and social integration into the IIT Bombay community.
- Promoted to Senior Mentor and led a team of 15 mentors for two consecutive years (2018-2020), equipping them with problem-solving skills and guiding them through challenges.

Counseling and Training Cabinet Head — Student Mentor Program, IIT Bombay July 2018 – May 2020

- Led a collaboration between the Student Wellness Center and Student Mentor Program, driving 100% undergraduate participation in mental health screening through innovative integration into mentor-led activities.
- Orchestrated institute-wide orientation for new department academic mentors (DAMP), incorporating faculty introductions, program objectives, and counselor-led case studies to promote mentor-student connection.
- Partnered with TATA Institute of Social Sciences to design and deliver an 8-hour mentor training program focused on communication and problem-solving skills.
- Organized mandatory POSH orientation for first-year students, promoting a gender-neutral campus at IIT Bombay.
- Revamped the Institute Student Mentor and DAMP Mentor handbooks and updated the First-Year Student Guide, enhancing mentor knowledge and promoting academic ethics, institute rules, and campus engagement for students.

Experiment Leader: Paper Planes Unleashed — Girls' Science Day, Columbia University Nov 2023

- Contributed to Columbia Engineering's Girls' Science Day, leading hands-on science experiment for middle school girls and fostering STEM interest within NYC communities.
- Designed an engaging experiment demonstrating how principles of aircraft design can be applied to enhance paper plane flight using a single paper clip.