

# Sainath Barbhai

barbhai2@illinois.edu | (217) - 926 - 6008 | linkedin.com/in/sainath-barbhai | Urbana, IL

## EDUCATION

<b>M.S. in Aerospace Engineering</b> , University of Illinois, Urbana-Champaign (Focus: Fluids and Combustion Studies)	<b>Jan 2022- Dec 2024</b>
<b>Combustion Summer School (1-week)</b> , Princeton University, New Jersey	<b>Jun 2023- Jun 2023</b>
<b>B.S. in Mechanical Engineering</b> , University of Mumbai, India (Magna Cum Laude)	<b>Jun 2018-May 2021</b>

## RELEVANT EXPERIENCE

### Graduate Research Assistant: Experimental Fluid Mechanics Oct 2023- Present

- Working with Prof. Jie Feng in the Fluid, Interfaces, and Transport (FIT) Lab to research and experimentally investigate the bursting phenomenon of non-Newtonian liquid-coated compound bubbles on a Newtonian free surface to understand the bursting dynamics of biocontaminated bubbles and their influences in transporting contaminants in marine ecosystems.
- Working on experimental investigation of non-Newtonian coating hollow compound droplets on a solid substrate to explore fluid dynamics, aerosol generation, and applications in fields like pharmaceuticals, coatings, and material synthesis.

### Teaching Assistant: ECE 445- Senior Design Laboratory Jan 2023 – Present

- Assisting teams consisting of ECE major senior students with their projects which aim to solve some real-life problems with a unique and innovative solution. Two out of five teams that I mentored received a prestigious class award.

### Hybrid Propulsion Student Engineer: Illinois Space Society of UIUC Feb 2022 – May 2023

- Designed the Oxidizer tank to successfully store Nytrox96 during the actual rocket flight that aims to reach 10,000 ft. vertically with a payload of 5kg.
- Conducted cold-flow tests of the manufactured engine to test the injector atomization and basic flow characteristics in the combustion chamber.

### Propulsion Simulation Engineer Intern: Manastu Space Technologies, India June 2021 – Dec 2021

- Appointed for the development of monopropellant satellite thrusters at this start-up in collaboration with the Indian Institute of Technology, Bombay (IIT-B) and the Defense Research and Development Organization (DRDO).
- Conducted several cold-flow and hot-flow tests with different geometry combinations to get the most optimum and reliable system based on test data analysis.
- Designed the propellant tank to minimize sloshing and its self-degradation against the propellant. Also, laid out its standard operating procedure (SOP).
- Conceptualized catalyst loading methods and developed an in-house catalyst shaker device that reliably increased the combustion efficiency by ~35% in just \$20 USD.
- Created numerical models to understand the combustion and decomposition kinetics of the propellant and catalyst used within our thruster system and verified the equilibrium composition with NASA CEA.

### Trainee Intern: Air India Engineering Services Ltd, India June 2019 – July 2019

- Worked in the Engines Overhaul Department on the maintenance of GE-90-115B, CFM-56-7B, Pratt, and Whitney PW 4056 Turbo Fan Engines.
- Worked in the Components Overhaul Division on the maintenance of Pressure Vessels (mainly on oxygen cylinders, and safety slide raft inflating cylinders), repair and overhauling of wheels and brakes of Boeing 737, 777-200, 777-300 ER, 747-400 & 787-8 Dreamliner, NDT processes such as fluorescent particle testing & magnetic particle inspection.

## PUBLICATION

- Yang, Z., Barbhai, S., Ji, B., and Feng, J., "Effect of Surface Viscoelasticity on Top Jet Drops Produced by Bursting Bubbles," *Soft Matter*, 2024. <https://doi.org/10.1039/D4SM00243A>

## PROJECTS AND EXTRA-CURRICULAR ACTIVITIES

- NAR Level 1 Certified High-Powered Rocket-** Designed and successfully launched ([on 2nd attempt](#)) a model rocket with an H-class high-powered motor. The apogee noted by the onboard altimeters was ~1430 ft. It had a 16" drogue chute and a 36" main chute (released at 300 ft. during descent), a 3D printed nose cone, and a 4-fin design. The [first attempt failed](#) due to the incorrect positioning of the motor into the metal casing, resulting in a fire and burning of the booster section of the rocket on the launch pad itself.
- Schlieren and Shadowgraph Imaging to Analyze Flow Fields-** Experimentally investigated velocity flow fields of a sub-sonic air jet and heat gradient from a soldering iron using a Z-type schlieren and shadowgraph imaging technique to understand the working fundamentals of it. The images taken were post-processed using Fiji ImageJ software.

- **Laser Doppler Velocimetry for Air Jet Velocity Estimation-** Performed this technique to measure fluid velocity by analyzing the frequency shift of laser light scattered by moving particles (oil droplets) within the fluid, to experimentally identify the velocity information of a sub-sonic air jet.
- **Delta wing wind tunnel testing and surface flow visualization:** Performed a lift, drag, and pitching moment analysis at different angles of attacks for a 65° sweep angle delta wing in a low-speed wind tunnel to understand its characteristics. Also, used oil-based flow visualization techniques to observe the aerodynamic properties of the wing.
- **Rocket Trajectory modeling using ODE methods:** Used MATLAB to [model the rocket trajectory](#) using the Runge-Kutta-4 (RK-4) and the Euler-based method on the initial boundary conditions of the rocket. The numerical analysis was performed in three sections- powered flight, unpowered ballistic flight until apogee, and ground impact.
- **Numerical Analysis of a Liquid Rocket Engine:** Developed numerical simulation models (Turbulent, Combustion, and Discrete Phase Models) to analyze different modified injector designs and achieved design optimization of the converging-diverging nozzle of an existing 50 N Liquid Rocket Engine.
- **Indian Society of Heating, Refrigerating, and Air Conditioning Engineers (ISHRAE):** Participated in a social activity conducted by ISHRAE where we engineering students explained our projects to underprivileged school kids to motivate them toward science.
- **SAE International colligate club Apsilon (Student-Run Organization):** Was associated with SAE International for 2 years as a member of SAE's collegiate club 'Apsilon' as a Program Head.

## SKILLS

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- **Tools-** MATLAB, SolidWorks, AutoCAD Mechanical, Ansys (FLUENT, Static Structural, Thermal, Topology Optimizer), ImageJ, Microsoft Office (Word, PowerPoint, and Excel), Gordon-McBride Chemical Equilibrium, OpenRocket, Laser-Cutting, 3D Printing, GD&T
- **Coursework-** Thermodynamics, Fluid Mechanics, Finite Element Analysis, Computational Techniques, Aerospace Propulsion (Air-Breathing & Rocket), Combustion Fundamentals, Intermediate Gas Dynamics, Optical Diagnostics for Propulsion, Rheology of Non-Newtonian Fluids, Finance Management

## AWARDS AND HONOURS

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- Got a sponsored trip by UIUC to attend the Massachusetts Institute of Technology's (MIT) New Space-Age Conference to learn more about the recent development in space technology and their future plans.
  - Won first place in the Illinois Design Challenge (April 2022) in the Brunswick i-Jet Challenge category for designing a '[Single Person Electric Scooter](#)' concept which was judged by Brunswick Corporation.
  - Stood 2<sup>nd</sup> in overall Mechanical Engineering department in the sophomore year of engineering.
  - Awarded multiple certificates in diploma for ranking 1<sup>st</sup> in the entire college for 2 consecutive years.
  - Won multiple awards (2<sup>nd</sup> & 3<sup>rd</sup>) place in Karate at both state and district levels.
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