Department of Aerospace Engineering

Research Topics from Faculty Members Interested in New PhD Students
Admission Cycle: May 2022

Aerodynamics

Prof. Avijit Chatterjee

Research Areas:

1. Computational Electromagnetics (CEM): Algorithm development and electromagnetic scattering applications in aerospace engineering
2. Aerospace configuration design involving CFD &/or CEM
3. Problems in aeroacoustics, high-speed flow, Magnetohydrodynamics

URL to Lab Website / Profile: https://www.aero.iitb.ac.in/~avijit/

Primary nature of research project: Computational / Design

Prabhu Ramachandran

- Hiring this season? **Yes**

- **Research Areas:**
  - Particle and meshless methods for continuum mechanics
  - Parallel and high-performance scientific computing (HPC)
  - AI and ML for PDEs

- **Skills/experience**: Background/interest in mathematical physics, numerical methods, and scientific computing

- More information: https://www.aero.iitb.ac.in/~prabhu/

Prof. Vineeth Nair

Hiring this season?: **Yes**

Research Areas:

- Experimental:Thermoacoustics, aeroacoustics (**hiring)**
  - Skills required: Knowledge of basic fluid mechanics, acoustics, measurement techniques, critical thinking
- Computational: Shock-turbulence interaction (**hiring),** simulation of reacting flows (**hiring)**
  - Skills required: C++ programming, numerical methods, critical thinking

URL to Lab Website / Profile: https://www.aero.iitb.ac.in/~vineeth

Primary nature of research project: Experimental/ computational

Prof. Aniruddha Sinha

Hiring this season?: **Yes**

Research Areas: Aeroacoustics, Reduced-order modelling of flows, Hydrodynamic stability analysis

Skills/experience: Background/interest in mathematical physics, numerical methods, scientific computing, theoretical fluid dynamics

URL to Lab Website/Profile: https://www.aero.iitb.ac.in/~aniruddha/

Primary nature of research project: Theoretical and moderately computational

Prof. Dhwanil Shukla

- **Hiring this season**: Yes

- **Research Areas:**
  - Rotorcraft Aerodynamics
  - Low Speed Aerodynamics
  - Experimental Methods for Flow Diagnostics

- **Lab URL: https://www.aero.iitb.ac.in/exp_aero_lab/**

- **Nature of Work:**
  - Mostly experimental (with some analytical and computational aspects)

- **Desirable Skills/Experience/Interest:**
  - Machine Design, Fabrication, Experimental Methods, Basic Programming, Tinkering

Prof. Viren Menezes

- **Hiring this season**: Yes.
- **Research areas**: Shock waves, hypersonics, aerodynamics, shock driven devices, high-frequency measurement techniques.
- **Essential background**: B.Tech/M.Tech in Aerospace Engineering or Mechanical Engineering or M.Sc. in Physics.
- **Specific domain of work (current hiring)**: Shock waves in solids: Stress measurement technique, analyses of deformation and wave dynamics*.
- **Nature of work**: Experimental and moderately computational using commercial codes.
- **URL**: https://www.aero.iitb.ac.in/home/people/faculty/viren

* in collaboration with Prof. Abhijit Gogulapati (AE)

Dynamics and Control

Prof. Arnab Maity

Hiring this season?: **Yes**

Research Areas:

❖ Guidance, Navigation and Control of Aerospace Vehicles
❖ Drones/Anti-Drones: Swarm Intelligence, Vision Aided Landing, Sense and Avoid, Unmanned Traffic Management, Geofencing, Drone Corridor
❖ Optimal and Adaptive Control
❖ Control and Estimation of Distributed and Cyber Physical Systems
❖ Fault Tolerant Control and Estimation, Fault Detection and Diagnosis

URL to Lab Website/ Profile: https://www.aero.iitb.ac.in/home/people/faculty/arnab

Primary nature of research project: Theoretical / Simulation/ Experimental

Prof. Shashi Ranjan Kumar

Hiring this season?: **Yes**

Research Areas:

- Guidance and Control of Autonomous Vehicles
- Cooperative Strategies for Aircraft Protection
- Spacecrafts: Attitude Control and Synchronization, Rendezvous and Docking
- UAVs/Drones: Cooperative Control, Collision Avoidance and Path Planning

URL to Profile: https://www.aero.iitb.ac.in/~shashi

Primary nature of research project: Theoretical/Computer Simulation

Useful skills/experience: Basic knowledge of control theory and solutions of ODE

Rohit Gupta

- Hiring this season? **Yes**

- **Research Areas:**

  1. Dynamical systems

  2. Geometric mechanics

  3. Geometric control theory and applications

  4. Optimal control theory and applications

  5. Optimization theory and applications

- **Primary nature of work:** Theoretical

Propulsion

Kowsik Bodi

Hiring this session? **Yes**

Projects available in Computational Studies of:

1. Hall Thrusters (Electric Propulsion)
2. Natural convection in fluids due to laser propagation
3. Internal ballistics of guns
4. Simulation of Reacting flows

URL to Lab website/profile: https://www.aero.iitb.ac.in/~kbodi/

Useful Skills/Experience: Numerical Methods, Programming experience (C++/Fortran)

Hrishikesh Gadgil

Hiring this session? **Yes**

Projects available in:

1. Spray-acoustics interaction, flame-acoustics interaction
2. Atomization of gel propellants (non-Newtonian liquids)
3. Secondary breakup and combustion of droplets
4. Simulation of trans/supercitical jets and flames

Primary nature of research project: Experimental and analytical, computational (4)

Useful Skills/Experience: Experimental methods, flow diagnostics, fluid mechanics (for 1-3), scientific computing and numerical methods (for 4)

Krishnendu Sinha

Hiring this session? **Yes**

Projects available in:

1. High-enthalpy flows
2. Shock-turbulence interaction
3. Heat transfer
4. Scramjet application

URL to Lab website/profile:

https://www.aero.iitb.ac.in/~krish/

Primary nature of research project: Computational and analytical

Useful Skills/Experience: Code development, CFD simulation

Sudarshan Kumar

Hiring this session → YES

Project available

1. Flame speed measurement at high pressure and temperature conditions
2. Flameless combustion and its applications to gas turbines
3. Endothermic fuel development
4. Flame instabilities in micro-channels

Primary nature of work: Largely experimental and partly computational

Useful Skills/Experience: Experimental methods, flow diagnostics, Kinetic modeling, Image processing, Combustion modeling

URL: www.aero.iitb.ac.in/~sudar

Nagendra Kumar

Hiring this session → Yes

Projects available:

1. High energy solid fuel for Hybrid rockets
2. Artificial ageing of solid propellants
3. Prediction of ballistic characteristics solid rocket motor
4. Erosive burning: Modeling and Experimental studies

Primary nature of work: Experimental and Computational

Useful Skills/Experience: Experimental methods, programming, use of computational tools (Ansys-Fluent)

A M Pradeep

Hiring this session → **Yes**

Projects available:

1. Turbomachines for ORC/SCO2 waste heat recovery systems
2. Aerodynamics of tandem + contra-rotating compressors

Primary nature of work: Experimental and Computational

Useful Skills/Experience: Familiarity with experimental techniques, data analysis and interpretation, Use of computational tools such as Ansys-CFX or Numeca

URL: https://www.aero.iitb.ac.in/~ampradeep/

Structures

Prof. Chandra Sekher Yerramalli

Hiring this season?: **YES**

Research Areas :

Google Scholar Link : https://scholar.google.co.in/citations?user=36hicnUAAAAJ&hl=en

URL to Lab Website / Profile: https://iitb.irins.org/profile/59571

Primary nature of research project: Modeling and Experimentation

Preferred Background : MTech with focus on Structures from either Civil or Aerospace or Mechanical. Background in Fiber composites and solid mechanics.