Department of Aerospace Engineering

Research Topics from Faculty Members Interested in New PhD Students

Admission Cycle: May 2023

Aerodynamics

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: Thermoacoustics, Acoustics of low Mach number flows

- Experimental: Acoustics of pipe flows (**hiring)**
  - Skills required: Knowledge of basic fluid mechanics, acoustics, measurement techniques, critical thinking
- Experimental: Thermoacoustic oscillations in a Rijke tube (**hiring)**

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

Primary nature of research project: Experimental

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. 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)**

Prof. Rajkumar S. Pant

- **Hiring this season: Yes.**
- **Research areas: Lighter-than-Air (LTA) Systems, Aircraft Design, Optimization, Air Transportation**
- **Essential background: B.Tech/M.Tech in Aerospace Engineering or Mechanical Engineering.**
- **Specific domain of work (current hiring): Optimum Design of Cargo Airships, Hybrid Unmanned Aerial Systems, LTA Systems for planetary exploration**
- **Nature of work: Design and Analysis, Computational studies using open-source codes.**
- **URL: https://www.aero.iitb.ac.in/~rkpant/**

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 UAVs/ Drones
- Underwater Drones or Surface Vehicles
- Cooperative Control, Collision and Obstacle Avoidance, and Path Planning
- Cooperative Guidance Strategies for Aircraft Protection
- Nonlinear and Robust Control
- Aerial Robotics

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

Primary nature of research project: Theoretical/Computer Simulations

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. Arc-heated flows
2. Plasma Propulsion devices for spacecrafts
3. Internal ballistics of guns

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

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

Hrishikesh Gadgil

Hiring this session? **Yes**

Projects available in:

1. Spray interactions in multi-injector configuration of rocket combustors
2. Atomization and combustion of gel propellants (non-Newtonian liquids)
3. Fundamental studies on the onset of pulsation and its response to the external periodic forcing in swirl coaxial injector

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. Combustion modelling of solid propellants
2. Two Phase Losses in solid rocket motor (experimental and Computations)
3. Artificial ageing of solid propellants
4. Barrel and muzzle velocity of artillery/Air gun
5. Laser ignition

Primary nature of work: Experimental and Computational
Useful Skills/Experience: Experimental methods, programming (Fortran), use of computational tools (Ansys-Fluent etc.), data analysis.

URL: https://www.aero.iitb.ac.in/home/people/faculty/nagendra

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/

T. Chandra Sekar

Hiring this session → **Yes**

Projects available:

1. Flutter prediction and Active Flutter Suppression in isolated wing and Turbomachines
2. Configuration design and performance prediction of next generation propulsion systems

Primary nature of work: Experimental and Analytical

Useful Skills/Experience: Familiarity with experimental techniques, data analysis. Knowledge on computational tools (Ansys-Fluent/CFX) is desirable.

URL: https://www.aero.iitb.ac.in/home/people/faculty/tchandra

Structures

Prof. Chandra Sekher Yerramalli

Hiring this season?: **YES**

Research Areas : Life and fatigue analysis, 3D composites for ballistics/crash, environmental damage analysis of composites

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.

Prof. Abhijit Gogulapati

Hiring this season?: **YES**

Research Areas :

A. Computational aeroelasticity and aerothermoelasticity
B. Numerical multi-disciplinary optimization

Primary nature of research projects: Numerical modeling and simulations; development of computational framework.

Potential topics of research: Several, depending on student interest, background, and capabilities.

Preferred Background : Competence in programming and algorithms. Aptitude and interest in numerical optimization strategies. Willingness to learn multiple disciplines.

Prof. Krishnendu Haldar

Hiring this season?: **YES**

Research Areas : Continuum mechanics, multiphysics coupling, biomechanics

Primary nature of research project: Physics-based material modeling, computational mechanics

Potential topic of research: Mechanics (and experiments) of magnetic materials, Computational biomechanics of TBI.

Preferred Background : Good math and physics knowledge. Knowing ABAQUS UMAT will be a plus.