

Department of Aerospace Engineering

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



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:

- Experimental: Acoustics of pipe flows (**hiring**)
 - Skills required: Knowledge of basic fluid mechanics, acoustics, measurement techniques, critical thinking

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)

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 Unmanned Autonomous Vehicles
- Underwater Drones or Surface Vehicles
- UAVs/Drones: Cooperative Control, Collision Avoidance and Path Planning
- Cooperative Strategies for Aircraft Protection

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 for spacecraft propulsion
2. Arc-heated flows
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. 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/>

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 :

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 : Optimization, multi-physics interactions

Primary nature of research project: Simulations, development of computational framework

Potential topic of research: Topology optimization of multidisciplinary systems using level set methods

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.