

# Gaurav Kumar

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## Education

- Indian Institute of Technology, Kanpur, India
  - ◇ Doctor of Philosophy July 2016 - Present
  - ◇ Grades: 9.0/10.0
- Indian Institute of Technology, Kanpur, India
  - ◇ B.Tech - M.Tech Dual Degree July 2011 - June 2016
  - ◇ Grades: PG- 10.0/10.0, UG- 7.7/10.0

## Research Interest

- Computational Fluid Dynamics
- Turbulence modeling
- Hypersonic flows
- Fluid-Structure interaction

## Journal Publications

### Article under Review

- **Kumar Gaurav**, De Ashoke "Development of a Density-based Flow Solver for All Mach Numbers in OpenFOAM with Low-Diffusive Flux Splitting Scheme", Journal of Computational Physics, Under review (From May 2019)

### Refereed Articles

- Mishra Alok, **Gaurav Kumar**, and Ashoke De. "Prediction of separation induced transition on thick airfoil using non-linear URANS based turbulence model." Journal of Mechanical Science and Technology 33.5 (2019): 2169-2180.
- **Kumar Gaurav**, Ashoke De, and Harish Gopalan. "Investigation of flow structures in a turbulent separating flow using hybrid RANS-LES model." International Journal of Numerical Methods for Heat & Fluid Flow 27.7 (2017): 1430-1450.
- **Kumar, G.**, Lakshmanan, S. K., Gopalan, H., & De, A. "Investigation of the sensitivity of turbulent closures and coupling of hybrid RANS-LES models for predicting flow fields with separation and reattachment." International Journal for Numerical Methods in Fluids 83.12 (2017): 917-939.

## Refereed Conference Proceedings

- **Kumar Gaurav**, De Ashoke "A density based compressible flow solver in OpenFOAM with Mach number preconditioning and Low-diffusive Flux Splitting Scheme" 7th International and 45th National Conference on Fluid Mechanics and Fluid Power (FMFP2018), Mumbai, India. 2018.
- **Kumar Gaurav**, Harish Gopalan, Dominic Chandar, Vinh-Tan Nguyen, and Ashoke De. "Verification of Length Scale Effects on Solution Accuracy of Hybrid RANS-LES Methods." ASME 2016 35th International Conference on Ocean, Offshore and Arctic Engineering. American Society of Mechanical Engineers, 2016.
- **Kumar, G.**, Lakshmanan, S. K., Gopalan, H., & De, A. "Comparative study of hybrid RANS-LES models for separated flows." AIP Conference Proceedings. Vol. 1738. No. 1. AIP Publishing, 2016.

## M.Tech Thesis

- **Indian Institute of Technology, Kanpur, India** **May, 2015 - June, 2016**
  - ◇ **Project title:** Investigation of Turbulent Separated Flow using Hybrid RANS-LES Models
  - ◇ **Advisor:** Dr. Ashoke De, Dr. Harish Gopalan
    - \* A non-linear blended modeling framework has been proposed.
    - \* A comparative study has been performed to investigate the sensitivity of hybrid RANS-LES models to the choice of RANS, LES and interface switching criteria.
    - \* Unsteady flow structures have been investigated in the turbulent separated flows to examine the effectiveness of hybrid RANS-LES models in the prediction of an accurate instantaneous flow fields.
    - \* New hybrid RANS-LES models developed has been proven to produce improved results at a very economical cost as compared to previous turbulence models.

## Internships

- **Institute of High Performance Computing, Singapore** **Jan-May, 2016**
  - ◇ **Project title:** Numerical Simulation of Flow Past Tandem Square Columns at High Reynolds Number Using Hybrid RANS-LES Models
  - ◇ **Advisor:** Dr. Harish Gopalan, Dr. Vinh-Tan Nguyen
    - \* Numerical simulations were carried out for flow past tandem square columns at high Reynolds Number using hybrid RANS-LES models.
    - \* Reduced order modeling techniques have been used to find out a simple force prediction method on such tandem column configurations.
- **National Aerospace Laboratories, Bangalore, India** **May-July, 2014**
  - ◇ **Project title:** Development of Endothermic Fuel Platform for Scramjet Engines and To probe Technology Readiness Levels Achieved by Different Countries.
  - ◇ **Advisor:** Dr. S. Venkat Iyengar, Senior Scientist, Propulsion Division
    - \* A literature survey was done on the progress of Endothermic Fuel Technology in different countries for its application in Scramjet Engine and Technology Readiness Level was assigned to the previous works on the basis of available literature.
    - \* The fundamental concepts about thermal cracking of long chain hydrocarbon fuels, its application in cooling of hypersonic vehicles and the problems associated with its application in scramjet engines have been studied in great detail.
    - \* A detailed roadmap has been suggested to develop this technology and to incorporate it in hypersonic scramjet air vehicle and a set of experiments required to be conducted and facilities required to be established in order to realize a TRL of 4 had been proposed.

## Industrial Project

- **Hindustan Aeronautical Limited, India** **Oct-Dec, 2016**
  - ◇ **Project title:** A Simulation of Cabin Pressure Control System
  - ◇ **Advisor:** Dr. Bishakh Bhattacharya, Professor, IIT Kanpur
    - \* A program has been developed to simulate the on-design and off-design performance of a cabin pressure control system for a supersonic fighter aircraft.
    - \* Optimal design parameters have been identified for constraining the off-design performance of the cabin pressurisation system within the regulations of Federal Aviation Administration.

## Course Projects

- **Rocket Engine Design** **July-Nov, 2014**
  - ◇ **Project title:** Rocket Engine Design to Transfer a Payload to Lower Lunar Orbit
  - ◇ **Advisor:** Dr. D. P. Mishra, Aerospace Engineering, IIT Kanpur
    - \* A theoretical design of three stage rocket engine was done to transfer a payload to lower lunar orbit.

- \* Detailed analysis was done for each step involved in the design based on the theory of Aero-thermodynamics of rocket engine and mechanical design.
- \* A road map was suggested as a guide for better understanding the rocket engine design process.

- **Aircraft Design- I**

**July-Nov, 2014**

- ◊ **Project title:** Design of a Turboprop Transport Cargo Aircraft
- ◊ **Advisor:** Dr. A. Tewari, Aerospace Engineering, IIT Kanpur
  - \* Designed a turboprop transport cargo aircraft satisfying specific requirements of range, cruise speed, fuel efficiency, pay load, etc.
  - \* Performance analysis was done and subsequently stability analysis was performed to verify if the aircraft meets all safety requirements.
  - \* With the calculated data, scaled CAD drawings of the designed aircraft were made.

- **Aeromodel Design and Fabrication**

**Jan-April, 2014**

- ◊ **Project title:** Design and Fabrication of a RC Plane Capable of a Wide Range of Maneuvers.
- ◊ **Advisor:** Dr. S. Kamle, Aerospace Engineering, IIT Kanpur
  - \* Objective was to make a RC plane capable of a wide range of maneuvers.
  - \* Styrofoam, chloroplast and plywood were primarily used for fabrication.
  - \* Our RC plane design achieved perfect gliding during landing.

## Workshop Attended

- "Immersed Boundary Methods for Turbulent Incompressible Flows" organised under "Global Initiative for Academic Networks" by IIT Kharagpur, December 18 - 22, 2017.

## Journals Reviewer

- Physics of Fluids
- International Journal of Numerical Methods for Heat and Fluid Flow

## Teaching Skills

- Teaching Assistant for **Introduction to Finite Volume Method II** (under NPTEL initiative) course, *Spring 2019*
- Teaching Assistant for **Thermodynamics (ESO201)** course, *Fall 2018*
- Teaching Assistant for **Engineering Drawing (TA101)** course, *Fall 2017*
- Teaching Assistant for **Fluid Mechanics and Rate Processes (ESO204)** course, *Spring 2017*
- Teaching Assistant for **Technical Communication (AE401A)** course, *Fall 2015*

## Relevant Courses

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|--|---|
| • Computational Fluid Dynamics           | • Turbulent Combustion                      |
| • Finite Element & Finite Volume Methods | • Molecular & High Temperature Gas Dynamics |
| • Turbulence                             | • Rocket Engine Design                      |
| • Transition to Turbulence               | • Aeroelasticity                            |
| • Boundary Layer Theory                  | • Aircraft Design and Aeromodeling          |

## Languages

- **English:** Professional working proficiency
- **Hindi:** Native mother tongue
- **German:** Elementary proficiency

## Technical Skills

- **Programming Languages:** C/C++, R with RStudio, Javascript, HTML/HTML5, CSS/CSS3
- **Softwares & Tools:** Ansys CFD Tools, OpenFOAM CFD toolbox, Tecplot, Paraview, gnuplot, AutoCAD, LabVIEW, GasTurb, MATLAB, MS office
- **Operating Systems:** Windows , Linux on most distributions