Gaurav Kumar

302, National Wind Tunnel Facility Building
Indian Institute of Technology, Kanpur
Kanpur, India, 208016

Mobile No.: +91 (876) 569 6536
Email-id : gauravkr@iitk.ac.in
Homepage: www.gauravkumar463.github.io

ACADEMIC DETAILS

Degree	Department	Institute	Year	CPI
Doctor of Philosophy	Aerospace Engineering	IIT Kanpur	2016 - Present	9.0/10.0
Master of Technology	Aerospace Engineering	IIT Kanpur	2011 - 2016	10.0/10.0
Bachelor of Technology	Aerospace Engineering	IIT Kanpur	2011 - 2016	7.7/10.0

FIELDS OF INTEREST

- Computational Fluid Dynamics, Turbulence modeling, Reduced order modeling, High speed flows

JOURNAL PUBLICATIONS

- **Gaurav Kumar** and Ashoke De. "Numerical study of viscous interaction between shock waves and separation region over a double wedge", submitted to Journal of Fluid Mechanics (March 10, 2020)
- Mitesh Thakor, **Gaurav Kumar**, Debopam Das, and Ashoke De. "Numerical investigation of low Reynolds number airfoil undergoing asymmetric sinusoidal pitching motion at a high reduced frequency", submitted to Physics of Fluids (March 5, 2020)
- **Gaurav Kumar** and Ashoke De. "An improved density based compressible flow solver in OpenFOAM for unsteady flow calculations", submitted to Computers and Mathematics with Applications (Dec. 29, 2019)
- Alok Mishra, **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 RANSLES models for predicting flow fields with separation and reattachment." International Journal for Numerical Methods in Fluids 83.12 (2017): 917-939.

CONFERENCE PROCEEDINGS

- **Gaurav Kumar** and Ashoke De. "Self-induced oscillations of the shock structures in a hypersonic flow over double wedge", to be presented at 25^{th} International Congress of Theoretical and Applied Mechanics (25th ICTAM), August 23 - 28, 2020
- **Kumar Gaurav**, De Ashoke "Effect of Turbulence in Unsteady Shock Interaction and Heat Transfer Mechanism in a Hypersonic Flow over Double Wedge", "32^{nd} International Symposium on Shock Waves", Conference proceedings ISSW32. 2019
- **Kumar Gaurav**, De Ashoke "A density based compressible flow solver in OpenFOAM with Mach number preconditioning and Low-diffusive Flux Splitting Scheme" 7^{th} 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 35^{th} 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.

WORKSHOP ATTENDED

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

PH.D THESIS

- **Numerical Study of Viscous Interaction between Shock Waves and Separation Region over a Double Wedge** *(Supervisor: Prof. Ashoke De)*
  - A new density based compressible flow solver is designed and implemented in an open-source CFD platform called OpenFOAM.
  - Improved stability and accuracy of the new solver is demonstrated through various test cases involving shock waves.
  - Flow over double wedge configuration is studied in detail to understand unsteady interaction between shock-waves and boundary layer/separation region.
  - A window of geometric parameter is identified which is crucial in avoiding design conditions which could result in catastrophic failures of hypersonic flights.

M.TECH THESIS

- **Investigation of Turbulent Separated Flow using Hybrid RANS-LES Models**
  (Supervisors: Prof. Ashoke De, Dr. Harish Gopalan)
  - A non-linear blended turbulence 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 tubulent separated flows to examine the effectiveness of hybrid RANS-LES models in the prediction of an accurate instantaneous flow fields.
  - Newly developed hybrid RANS-LES model has been proven to produce improved results at a very economical cost as compared to the previous turbulence models.

INTERNSHIPS AND MAJOR PROJECTS

- **Hindustan Aeronautical Limited, India** (Research Assistant, Oct - Dec, 2016)
  (Supervisor: Prof. Bishakh Bhattacharya, Professor, IIT Kanpur)
  - **Project Goal:** Simulation of Cabin Pressure Control System.
  - **Goal achieved:** A program had been developed to simulate the on and off-design performance of a cabin pressure control system. Optimal design parameters had been identified for constraining the off-design performance of the cabin pressurization system within the regulations of FAA.

- **Institute of High Performance Computing, Singapore** (Research Assistant, Jan - May, 2016)
  (Supervisor: Dr. Harish Gopalan, Dr. Vinh-Tan Nguyen, Scientist)
  - **Project Goal:** Numerical simulation of flow past tandem square columns at high Reynolds number using hybrid RANS-LES models.
  - **Goal achieved:** 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** (Research Assistant, May - July, 2014)
  (Supervisor: Dr. S. Venkat Iyengar, Senior Scientist, Propulsion Division)
  - **Project Goal:** Development of endothermic fuel platform for scramjet engines and to probe Technology Readiness Levels (TRL) achieved by different countries.
  - **Goal achieved:** A detailed roadmap was suggested to develop endothermic fuel technology and to incorporate it in hypersonic scramjet air vehicle. A set of experiments required to be conducted and facilities required to be established had been proposed in order to realize a TRL of 4.

TEACHING EXPERIENCE

- **Teaching assistant:** Introduction to Finite Volume Method II (*under NPTEL initiative*), Thermodynamics, Engineering Drawing, Fluid Mechanics and Rate Processes, Technical Communication.

SKILLS

- **Languages:** English (Professional working proficiency), Hindi (Native mother tongue), German (Elementary proficiency), Chinese (Elementary proficiency)
- **Programming & Scripting**: C/C++, R, MATLAB, gnuplot, HTML/HTML5, CSS/CSS3
- **Softwares & Tools**: Ansys CFD Tools, OpenFOAM CFD toolbox, Tecplot, Paraview, AutoCAD, MS office

INTERESTS AND HOBBIES

- Playing Tennis, running, swimming, reading and traveling.