ANUJ KUMAR

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EDUCATION:

PhD, Mechanical and Aerospace Engineering, NC State University, Raleigh *Aug'19- Present*
CGPA of 3.9/4

B. Tech, Mechanical Engineering, Indian Institute of Technology Kanpur, India *June' 16*
CGPA of 8.4/10

TECHNICAL SKILLS:

- **Languages and Computational skills :** FORTRAN, C, MATLAB, MPI, OpenMP, PETSc, ARPACK
- **Software packages:** Tecplot, Ansys, AutoCAD, Autodesk Inventor
- **Data- Driven Methods:** POD, DMD, SINDy, Clustering methods, ANN

RESEARCH EXPERIENCE:

Graduate Research Assistant, NCSU *Aug'19- Present*

Analysis of Shock wave turbulent boundary layer interaction

- Resolvent analysis about the time averaged mean turbulent data
- Performed singular value decomposition of very large Resolvent matrices through PARPACK and PETSc
- Obtained the shock interaction features through Reduced order representation of the forcing and response modes
- Captured the low frequency unsteadiness and bubble breathing after the flow separation from the shock

Analysis of compressible turbulent boundary layer

- Captured the dominant coherent structures of the boundary layer from the mean flow data through Reduced order representation of the response modes in the Resolvent analysis
- Details about frequency, shape and position of the coherent structures were determined

Summer Research Project, IIT Kanpur *May' 14 – Jul' 14*

Computational Analysis of suppression of the vortex shedding around a square cylinder.

- Numerically investigated flow around a square cylinder; discretizing Navier-Stokes equation by Marker and Cell Method
- Identified suppression region and obtained drag coefficient for various sizes of control cylinder and Reynolds number

ACADEMIC PROJECTS:

POD, DMD, and Resolvent analysis of Compressible Turbulent Channel Flow *Nov' 20*

- Reduced order basis for the turbulent flow is obtained in form of dominant POD and DMD modes.
- Dominant flow frequencies and structures were confirmed by finding similarity in DMD and Resolvent modes

Development of an FVM solver for Euler equations on unstructured grids *March' 20*

- A solver was developed in FORTAN for 2D compressible Euler equation on unstructured meshes
- Evaluated Fluxes using the Van Leer flux vector splitting method (1st order accurate) and reconstruction-evolution method (MUSCL) with Van-Albada slope limiting (2nd order accurate).
- Tested the solver for subsonic flow past a circular cylinder, transonic flow past a NACA0012 airfoil and supersonic flow in a channel with a circular bump

Development of a solver for Reacting- gas Nozzle flow with Scramjet Conditions *March' 20*

- A FVM based solver was built in FORTRAN to model the reacting gas flow through a C-D nozzle
- Upwind Flux schemes like Van-Leer, LDFS were used to model spatial discretization
- Modelled the chemical reaction, the hydrogen oxidation, through the abridged Jachimowski form

Multiphase- Flow modelling in a 1 D nozzle *Apr' 20*

- A solver was built to solve the Euler equations with supersonic flow conditions for a real fluid as it changes its phase through a C-D nozzle.
- The thermodynamics of the real fluid (C2H4) was modeled using the Peng Robinson equation of state

SCHOLASTIC ACHIEVEMNETS:

- Recipient of **Academic Excellence Award** for terms 2014-15, for distinctive academic performance at IIT Kanpur
- Secured an **All India Rank-2410** in IIT-JEE (Joint Entrance Examination) 2012 among 0.5 million candidates for admission into the Indian Institute of Technology
- Achieved an **All India Rank-1717** in All India Engineering Entrance Examination 2012 out of 1.2 million applicants
- Achieved **State Level Rank-510** in Uttar Pradesh State Entrance Examination among 0.2 million candidates
- Qualified centre sponsored **JNVST** (Jawahar Navodaya Vidyalaya Selection Test) -2004

SUMMER INTERNSHIP: GENERAL ELECTRIC, India *(May 2015 – July 2015)*

Analysis of Thermal Buckling in a Jet Engine Compressor Disk

- Investigated critical temperature for various modes using pre-existing literature on buckling of a solid disk
- Modelled a solid disk and obtained the solution using eigenbuckling analysis on Ansys, matched with theoretical results
- Predicted factor of safety for the Jet engine compressor disk using solutions procedure as used for the solid disk

RELEVANT COURSES:

Computational Fluid Dynamics-I	Foundation of Fluid Dynamics	Data- Driven analysis and modelling
Computational Fluid Dynamics-II	Programming and Numerical Analysis	Numerical Analysis-I
Computation of Reacting Flows	Viscous Flow Theory	High performance Computing

POSITION OF RESPONSIBILITY:

Manager, Mechanical Maintenance Team, Tata Steel Limited *July' 17- July'19*

- Ensured availability of Sinter Plant Mechanical equipment as per set target
- Led a team of 25 members and trained them on various training modules

Secretary, Association of Mechanical Engineers, IIT Kanpur *May' 13- Apr' 14*

- Worked with team of 10+ for smooth conduction of various lectures and seminars related to recent research activities
- Organised Happy Hours to facilitate interaction between students and departmental faculty at regular intervals

EXTRA-CURRICULAR ACTIVITIES:

Successfully completed Outdoor Leadership Course conducted by Tata Steel Adventure Foundation

- Undertaken various adventures activities like Rappelling, River Crossing, Camping, and Trekking up to Mudga Top
- Lead and Motivated the group in difficult situations and learnt about abilities, limitations, and learning needs of myself

Spearheaded many activities as cadet of National Cadet Corps, 2 UP Composite Technical Regiment

- Participated in various adventurous activities like parasailing and target shooting, and in rallies to spread awareness

Volunteer in Tata Steel CSR

- Successfully organised Blood donation camps, spread road safety awareness in villages, arranged resources for deprived
- Closely worked with disables in digital literacy programme, career awareness workshops.

Sports- Event participation

- Successfully **completed** Tata Steel Bhubaneswar **Half- Marathon** 2018 within two hours
- Represented Tata steel Kalinganagar twice in Inter-Department **Badminton championship** held in Jamshedpur
- Secured **First position in 5 Km** run-a-thon organized by Tata Steel Kalinganagar
- Secured **First position in 400m, 200m** sprint race in annual TSK sports event