Vishal Kumar
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Research Interests

- Aerodynamics and flow control.
- Roughness effects on transition & turbulence.
- Application of Machine Learning in turbulence modelling.
- Sediment transport due to turbulence.

Experience

Teaching Fellow Sept 2022 - Dec 2022
Queen's University, Canada
- Instructor for 3^{rd}-year Thermodynamics course.

Research Assistant Sept 2016 - Dec 2022
Queen's University, Canada
- Worked on turbulence simulation and modelling of flow over airfoils with rough leading edges.

Research Assistant Sept 2014 - Aug 2016
Iowa State University, USA
- Worked on inverse turbulence study of $k-\omega$ SST model for streamline curvature and rotation.

Executive Engineer Aug 2011 - May 2013
Thermax Ltd., India
- Worked on numerical simulation & development of Vapor Absorption based Refrigeration cycles.

Education

Doctor of Philosophy (Ph.D.) Dec 2022
Mechanical Engineering, Queen's University, Canada
- Dissertation title: Leading edge roughness effects on flow over airfoils
- Advisor: Professor Ugo Piomelli

Master of Science (M.S.) Aug 2016
Aerospace Engineering, Iowa State University, USA
- Dissertation title: Inverse Turbulence Modeling of Channel flow using continuous Adjoint method
- Advisor: Professor Paul Durbin

Bachelor of Engineering (B.E.) May 2011
Mechanical Engineering, BITS Pilani, India

Refereed Journal Publications

1. **Kumar, V.**, Piomelli, U., and Lehmkuhl, O. "Large-eddy simulations of the flow on an aerofoil with leading edge imperfections" *J. Turbul.* 1–26, 2021.

2. **Kumar, V.**, Miró A., Lehmkuhl O., Piomelli U. "Flow separation in airfoils with rough leading-edges." (accepted by AIAA J.)

Conference Proceedings

1. **Kumar, V.**, Piomelli, U., and Lehmkuhl, O. "Large-eddy simulations of the flow on an aerofoil with leading edge imperfections". Presented at 74^{th} Annual meeting of APS-DFD, Phoenix, AZ. November 20-22, 2021
2. **Kumar, V.**, Miró A., Lehmkuhl O., Piomelli U. "Flow separation in airfoils with rough leading-edges". Presented at 75^{th} Annual meeting of APS-DFD, Indianapolis, IN. November 20-22, 2022

Awards

Student awards

- Mitacs Accelerate fellowship — Jan 2018

Teaching Experience

Teaching assistantship at Queen's university, Canada

- Computational Fluid Dynamics
- Mechanical Engineering Lab II (Lift & Drag)
- Mechanical Engineering Lab I (Refrigeration Lead TA)
- Thermodynamics I
- Mathematical and Computational Tools for Mechanical Engineers II
- Fluid Mechanics I

Internships

Undergraduate Internships

- TATA Systems Ltd., Pune, India — Jan, 2011-June, 2011
- Steel Authority of India Ltd., Shimoga, India — May, 2009-July, 2009

Professional Activities

Journal Referee:

- Journal of Turbulence

Professional affiliations:

- Member, American Physical Society (APS)

Outreach Activities

Community outreach

- Teacher at Abhigyaan (India) to provide education to underprivileged section of the society. (Jan 2008 - Dec 2009)
- Substitute teacher at local elementary school, Narayanpur, UP, India. (Jan 2016 - March 2016)

References

1. Professor Ugo Piomelli

   FRSC, FAPS, FASME, FCAE
   Canada Research Chair in Turbulence Simulation and Modelling
   Queen's University, Kingston, Canada
   Phone: (+1) 613 533 2758 email: ugo@queensu.ca

2. Dr. Oriol Lehmkuhl

   Large-scale Computational Fluid Dynamics Team Leader

Barcelona Supercomputing Center, Spain
Phone: (+34) 934 137 193 email: oriol.lehmkuhl@bsc.es

Professional Skills

Highlights of turbulence research skills

- Experience in working with three CFD simulation codes: Alya, Nek5000 and OpenFoam
  - experience in large scale aerodynamic simulations with Niagara CPU cluster
  - experience with exascale variants of Alya and Nek5000 (NekRS) on Compute Canada's Mist & Béluga clusters
- Experience in performing direct numerical, large eddy simulations of complex flows
- Experience in implementation of first and second order immersed boundary methods
- Experience in Adjoint formulation within finite-difference framework
- Experience in implementation of Proper orthogonal and Dynamic mode decomposition techniques in Python/VTK framework
- Experience in research communication:
  - Successfully co-wrote a proposal for large computational resource grant from SOSCIP, Canada
  - Communicated updates to industry partner (Bombardier Aerospace, Canda): 5 written reports and 4 annual presentations
  - Published two peer-reviewed journal articles and gave two conference presentations

1. Computer Programming:
   - Fortran, C, Python, MATLAB, HPC (MPI/Open MP), VTK, Shell script
2. CFD Analysis Softwares:
   - Alya, OpenFoam, Nek5000, Gmsh, Salome, Pointwise, ParaView, Tecplot

Last updated: January 16, 2023