Neelappagouda V Hiregoudar

Graduate student

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Topic of Interests

Artificial Intelligence (AI), Computational Fluid Dynamics (CFD), Compressible flows and FOSSs.

Experience

École Centrale School of Engineering (Mahindra University)

Hyderabad, India

Junior Researcher

July, 2022 - Present

- **Title:** Development of a framework for Turbulence modelling using Physics Informed Neural Networks (PINNs).
- **Role:** Address the **Spectral Bias** in **turbulence modeling** and implement the modulus or open-source approach to resolve the Kolmogorov scale using **Physics Informed Neural Networks (PINNs)**. Furthermore, it aims to resolve shocks (which is still fertile ground).
- **Sponsoring Agency:** Aeronautical Research and Development Board (ARDB).

Indian Institutes of Technology, Kharagpur

Kharagpur, India

Junior Research Fellow

Oct, 2021 - July, 2022

- **Title:** Development of a Hybrid Continuum to Atomistic Scale Solver for Multi-scale Flow Problems.
- **Role:** Implement the **Deep Learning** based solution of Poisson's equation into Multi-scale Flow solver.
- **Report URL:** https://github.com/neelu065/Poisson CNN usage.pdf
- **Sponsoring Agency:** National Supercomputing Mission (NSM).
- **Supporting Agency:** **NVIDIA**.

Indian Institutes of Technology, Bombay

Mumbai, India

Research Assistant

Apr, 2021 - Oct, 2021

- **Title:** Prediction of Spatial and Temporal Evolution of Atmospheric Optical Turbulence using Computational Fluid Dynamics (CFD).
- **Role:** Understand the usage of Meso-NH (Fortran) and PyCLES (Python) framework.
- **Sponsoring Agency:** Defence Research and Development Organisation (DRDO).

Education

The Pennsylvania State University (Penn State)

State College, PA, US

Doctor of Philosophy

Aug, 2023 - continuing

Specialization in Information Sciences and Technology

Joined in Aug, 2023 and continuing with the course works.

Indian Institute of Space Science and Technology (IIST)

Thiruvananthapuram, India

Master of Technology in Aerospace Engineering

Jul, 2018 - Aug, 2020

Specialization in Aerodynamics and Flight Mechanics

- **CGPA : 7.43/10**
- **Courses Attended :**
  - Computational Methods in Compressible Flows
  - Aerodynamics
  - Compressible Flow
  - Space Dynamics
  - Aerospace Vehicle Design
  - Turbo Machines

Sri Jayachamarajendra College of Engineering (SJCE)

Mysore, India

Bachelor of Engineering in Mechanical Engineering

Aug, 2013 - May, 2017

- **CGPA : 8.42/10**
- **Courses Attended :**
  - Finite Elements Methods
  - Fluid Mechanics
  - Mechanical Vibrations
  - Heat and Mass Transfer
  - Thermodynamics
  - Strength of Materials
  - Engineering Mathematics
  - Operation Research

Government College

Gadag, India

Class 12

Mar, 2013

- **Percentage : 87%**

Sri C.D.O Jain School *Gadag, India*

Class 10 *Mar, 2011*

- **Percentage : 82%**

Projects

Master's Thesis

Multimodal Shape Optimization Of NACA0012 Wing With Differential Evolution Based Parallel Niching Algorithm and Reduced-Order Modeling Technique. *IIST college, Thiruvananthapuram, India*

Supervisor : Dr. Devendra Prakash Ghate *Jul, 2019 - Aug, 2020*

This thesis involves identifying multimodality for the NACA0012 wing (**ADODG case-6 problem**). The Differential Evolution (DE) based niching algorithms (with little or no modification) are implemented on NACA0012 wing to obtain multiple local optima. The mesh points spread over the NACA0012 airfoil using a cosine distribution function. A **Free-Form Deformation** (FFD) box with 60 control points is set-up over the NACA0012 wing, which resulted in 125 Dimensional optimization problem. With the help of **Principal Component Analysis** (PCA), the problem dimension is reduced to 10 based on its percentage of random energy (λ^2). A glyph script creates the wing tip followed by the volume mesh to all perturbed wings, and the **SU2 solver** will evaluate for Coefficient of lift (Cl) and Coefficient of drag (Cd). The entire optimization problem carried out in subsonic, inviscid condition (M = 0.4) subjected to several constraints with reasonably higher residual value. A full-fledged optimization code written in **Python** and submitted to the **HPC cluster via SLURM**. The python code related to this project can be assessed using GitHub link, *Thesis-codes*.

The outcome of the project is as mentioned below.

- A total of four optima are obtained with objective function varying < 8% and a residual value of 10^{-12}.
- Fine-tuning of CFD solution is necessary to analyse the work properly.

Due to COVID-19 pandemic, the computational facility is turned off, which hindered further expansion of the project to the viscous flow field. The entire thesis can be accessed using the GitHub link as mentioned, *Thesis-file.pdf*.

Tools used: Pointwise (meshing software), Paraview (Post-processing software), SU2 (CFD solver), Linux shell script, Python (Constructing framework), SLURM (Submitting jobs to HPC cluster).

Assisted Projects

Aircraft Climb Optimization. *IIST college, Thiruvananthapuram, India*

Supervisor : Dr. Devendra Prakash Ghate *Oct, 2019*

The project focuses on the climb trajectory optimization for aircraft. By finding a feasible and optimal path, it can be proved that gallons of fuel can be saved, which in turn reduce the cost incurred to the company. There were in total forty-one design variables, and the objective was to optimize fuel consumption with several constraints like maximum weight carrying capacity, service ceiling, the maximum angle of attack, to name a few.

- My role in this project is to make bachelor student understand the Differential Evolution (DE) algorithm and help him to implement the gradient-free algorithm.

Variable-Thrust Optimization of Ascent Trajectory of a Two-Stage Launch Vehicle. *IIST college, Thiruvananthapuram, India*

Supervisor : Dr. Aravind Vaidyanathan *Mar, 2020 - Apr, 2020*

The objective of this project is to optimize the thrust of a two-stage rocket based on the pitch rate defined at several points along the trajectory. The problem is defined using 41 variables (Dimension) containing kick rate, and pitch rates defined at equal intervals along the trajectory. Furthermore, with the 200 initial population, the gradient-free algorithm (DE) is used to optimize the thrust. The constraints were that the flight path angle needs to be zero at the orbital height. In this problem, the feasibility rules as proposed by Deb and Saha, for constraints satisfaction is implemented.

- My participation in this project was to set up the problem objective and check for constraint satisfaction in the most efficient way. Python programming is used to set up the entire problem.

Bachelor's Thesis

Experimental Investigation On Conventional Heat pipes Using Various Working Fluid. *SJCE college, Mysore, India*

Supervisor : Dr. Ezhil Vannan S *Jul, 2016 - May, 2017*

The objective of this project is to compare the performance of Heat pipe when subjected to various working fluids. Here, the Aluminium and Copper pipes of specified dimension are fabricated into Heat pipes with mesh inserted inside the pipes. Working fluids like double distilled water, acetone, Cupric oxide nanofluid are used. Results are compared by subjecting the Heat pipes to temperature gradient using a heat source (90 Watts). A comparative study is carried out between straight Heat pipe and the bend Heat pipes.

The outcomes are as follows:

- The rate of heat dissipation depends on working fluids and is maximum for nanofluids.
- The bending of Heat pipe reduces the heat transfer rate due to the increase in the vapour transport resistance.

Skills

Programming	Python (excellent), bash (excellent), MATLAB (good), C++ (beginner)
D/L Frameworks	Tensorflow, PyTorch
CFD Framework	OpenFOAM (moderate), SU2 (excellent), Ansys (moderate)
Languages	English (proficient), Hindi (good), Kannada (regional language)(proficient)
Others	Version Control System (Git)

Test Scores

TOEFL - Test of English as a Foreign Language *Hyderabad, India*

Conducted by Educational Testing Service *Oct, 2022*

- Score : **84 (S-25, W-22, L-20, R-17)**.
- Verification URL : https://github.com/neelu065/TOEFL score neelappagouda.pdf

GATE - Graduate Aptitude Test in Engineering, Mechanical Engineering *Hyderabad, India*

Conducted by Department of Higher Education, Government of India. *Jun, 2017 - Feb, 2018*

- Secured **96.96 percentile**.
- Earned MHRD (Ministry of Human Resource Development) scholarship for the entire duration of Master's program.
- Verification URL : https://github.com/neelu065/Gate score neelappagouda.pdf

Achievement and Certification

Neural Networks and Deep Learning

Certificate course Conducted by DeepLearning.AI *Dec, 2021*

- Certificate Issuing Organization : Coursera.
- Verification URL : https://www.coursera.org/account/accomplishments/certificate/KQZLC4GH76U6.

Using Python to Interact with the Operating System

Certificate course Conducted by Google *Sept, 2020*

- Certificate Issuing Organization : Coursera.
- Verification URL : https://www.coursera.org/account/accomplishments/certificate/F3J3BXZQU6HD.

Operating Systems and You: Becoming a Power User

Certificate course Conducted by Google *May, 2020*

- Certificate Issuing Organization : Coursera.
- Verification URL : https://www.coursera.org/account/accomplishments/certificate/J9E9W6PD8U4W.

Introduction to Git and GitHub

Certificate course Conducted by Google *May, 2020*

- Certificate Issuing Organization : Coursera.
- Verification URL : https://www.coursera.org/account/accomplishments/certificate/VX7SWWRWC4MC.

Additional Activity

Managed Several Cultural Events During Master's Program *IIST college, India*

Event Coordinator

- In charge of events conducted during Junior Induction program.

Hobbies

Solo Traveller

Travelled to all major cities in India

- Himalayan range is yet to be covered.

Cyclist

Often go for a long cycle ride during weekends

- The most exciting journey of 140 kilometers is covered in less than eight hours.

Photography

in charge of media house during events in the Master's program

- Post-Processing the event images using programming languages like MATLAB, Python, etc.