Faiq Shahbaz

+92-3324793085 | faiqshahbaz726@outlook.com | linkedin.com/in/faiq07 | github.com/FaiqShahbaz

Education

National University of Sciences & Technology (NUST) — **Islamabad, Pakistan**

Master of Science in Computational Science & Engineering — *Sep. 2023 – August 2025*

- **CGPA**: 3.60/4.00
- **Thesis Grade**: A
- **Thesis Title**: CFD based Design and Optimization of Ducted Wind Turbine
- **Courses**: Advanced Fluid Mechanics, CFD-I, CFD-II, 3D Geometric Modeling and Reconstruction, Computational Linear Algebra & Optimization, Applied Mathematics, Data Analysis & Statistics, High Performance Computing.

Institute of Space Technology (IST) — **Islamabad, Pakistan**

Bachelor of Science in Aerospace Engineering — *Sep. 2018 – Jul. 2022*

- **Majors**: Aerodynamics & CFD
- **Thesis**: Design & Analysis of Airborne Wind Energy (AWE) System

Experience

CFD Support Engineer — **May 2025 – Present**

FORBMAX — *Islamabad, Pakistan*

- Providing CFD and HPC support for a KAUST-funded project at FORBMAX, in collaboration with KAUST researchers.
- Delivering expert consulting for a range of CFD research and engineering projects, guiding users through complex simulation and modeling challenges.
- Designing and conducting training workshops, including the creation of instructional content to improve user proficiency in CFD and HPC systems.
- Administering and optimizing performance of the dedicated CFD computing cluster, including software setup, troubleshooting, and resource management.

Research Associate — **July 2024 – May 2025**

National University of Sciences and Technology (NUST) — *Islamabad, Pakistan*

- Conducted aerodynamic design and CFD simulations of ducted horizontal-axis wind turbines (HAWTs) for low wind conditions.
- Designed and optimized blade profiles for different Reynolds numbers and Tip Speed Ratios (TSRs) using a custom Python-based solver, validated via BEMT analysis.
- Achieved a peak power coefficient of 0.86 (104% improvement) using ducted rotor configurations.
- Validated performance through wind tunnel testing of 3D-printed blades and duct integrated into a prebuilt 200W turbine.
- Developed a custom data acquisition system for real-time capture of turbine performance metrics in controlled settings.

Intern — **June 2024 – September 2024**

Dense Fusion — *Islamabad, Pakistan*

- Utilized PETSc for developing and implementing numerical algorithms, including the formulation and coding of solvers for various equations.
- Engaged in the development and customization of OpenFOAM solvers, utilizing MPI to enhance computational capabilities for high-performance applications.
- Created and implemented various Transport equations code in Python, Parallelized solvers using MPI and conducted scalability tests to ensure performance and stability.
- Collaborated with two professors from KAUST University to prepare comprehensive materials for upcoming workshops, focusing on advanced computational methods and solver development.

Skills & Tools

Programming Languages: Python, C++, MATLAB
Libraries & Tools: PyTorch, PETSc, MPI, Git, Docker, Conda, Visual Studio, PyCharm, LaTeX
CFD & FEM Software: OpenFOAM, DAFoam, ANSYS, STAR-CCM+, Comsol
Meshing & CAD Tools: Pointwise, ICEM CFD, CATIA, Blender
Other Software: OpenVSP, Simulink, AAA, DATCOM, Qblade, Dymola, Raymer RDS
Soft Skills: Teamwork, Problem-solving, Technical Documentation, Time Management

Research Projects

Hybrid CFD–Deep Learning for Thermal Flow Prediction in Data Centers | *Python, PyTorch, CFD*

- Developed surrogate CNN models trained on 2,000+ CFD-generated thermal contour images to predict airflow and hotspot formation in server racks.
- Benchmarked three encoder–decoder architectures, achieving 95% accuracy, L2 loss of 0.003, and PSNR of 24.84 dB on unseen data.
- Reduced prediction time from ∼4 minutes per CFD case to 0.07 seconds (6000× speed-up), enabling real-time thermal monitoring and design space exploration.
- Proposed framework extensions for 3D transient predictions, physics-informed loss functions, and integration with sensor-driven digital twin systems.

Optimization of GEKO Turbulence Model for Ahmed Body Flow | *ANSYS Fluent, Python*

- Performed sensitivity analysis on GEKO model parameters for the 25° slant Ahmed body using Sobol and Morris methods.
- Ran multiple RANS simulations to vary GEKO coefficients and identify their impact on drag and pressure distribution.
- Developed a surrogate model to optimize GEKO coefficients and minimize error between CFD results and experimental data.
- Used Bayesian optimization to fine-tune GEKO parameters for improved accuracy.
- Validated the optimized GEKO model across different slant angles and configurations to ensure robustness.

Physics-Informed GNN Surrogates for CFD Prediction | *OpenFOAM, PyTorch Geometric, Python*

- Developed an automated pipeline integrating OpenFOAM simulations with Graph Neural Networks (GNNs) for mesh-aware surrogate modeling of flow over a cylinder.
- Generated large-scale CFD datasets across varied flow regimes; extracted fields (velocity, pressure, turbulence) and force coefficients using OpenFOAM function objects.
- Processed simulation data into PyTorch Geometric graphs with spatial and physical node features, annotated with simulation metadata.
- Trained GCN and GAT models to predict node-level flow fields; evaluated using RMSE and R^2 metrics.

GNN-Based Prediction of Airfoil Aerodynamics | *Python, PyTorch*

- Automated generation of 1000+ airfoil simulations using XFOIL with varied geometry and flow conditions.
- Trained GNNs to predict aerodynamic coefficients (Cl, Cd, Cm, Cdp) directly from airfoil geometries.
- Developed evaluation and visualization pipeline to benchmark predictions and assess model generalization on unseen shapes.

Organizational & Managerial Skills

Space Society IST	*Director*	2020-2022
International Conference on Aerospace Science and Engineering (ICASE)	*Manager*	2020
IST Youth Carnival (IYC)	*Manager*	2020
World Space Week	*Manager*	2019

References

Dr. Rooh Khurram
Computational Scientist, KAUST Supercomputing Laboratory — *Rooh.Khurram@kaust.edu.sa — +966 54 470 1571*

Dr. Ammar Mushtaq
Associate Professor, SINES, NUST — *ammar.mushtaq@sines.nust.edu.pk — +92 51 9085 5736*

Dr. Shahzad Rasool
Associate Professor & Head of Department, SINES, NUST — *shahzad.rasool@sines.nust.edu.pk — +92 51 9085 5737*