

# Vishal Singh

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## EDUCATION

### Thapar Institute of Engineering and Technology

Bachelor of Engineering, Mechanical Engineering

– Cumulative GPA : **9.00/10.0**

Patiala, Punjab

August 2021 – June 2025

## EXPERIENCE

### SciML Intern

NMCAD Lab, Indian Institute of Science

April 2025 – Present

Bengaluru, India

- Engaged in advanced research at the NMCAD Lab, focusing on the optimization of auxetic metamaterial structures, modeling of fatigue crack growth (FCG), and Industry 4.0 applications. Contributed to **3 journal publications** and **2 accepted conference papers**.

### Machine Learning Intern

JuliaHub

January 2025 – March 2025

Bengaluru, India

- Reproduced core pipeline results (DataGeneration, Preprocessing, and DigitalEcho) from the JuliaSimSurrogates repository, and created detailed deployment documentation tailored for the GUI team, ensuring 100% understanding of the MTK model workflow for seamless integration.
- Implemented gradient testing in `Surrogate.jl`, streamlining testing workflows and reducing execution time from **3 hours to 1.5 hours**, enabling scalable training improvements while consistently meeting deadlines.

### Samsung PRISM Intern (Remote)

Samsung R&D Institute

October 2024 – April 2025

Bengaluru, India

- Developing a video generation framework using diffusion models to generate 720p videos at 30 FPS with improved temporal consistency; mentored by researchers from Samsung's Visual Intelligence Team.

### Undergraduate Research Assistant

Thapar Institute of Engineering and Technology and IITDM Kancheepuram

February 2024 – June 2025

Patiala, Punjab

- Conducting research in aerospace engineering, biomedical engineering, and computational solid mechanics.
- Applying advanced machine learning techniques including Physics-Informed Neural Networks (PINNs), Neural Operators, Kolmogorov-Arnold Networks (KANs), and Physics-Informed KANs (PI-KANs) for solving real-world problems.
- Contributed to projects focused on AI for science, healthcare, and social impact. Achievements include one published research paper, one under review, one accepted conference paper, and one patent application submitted.

### MITACS Globalink Research Intern

École Polytechnique de Montréal (Fully Funded)

June 2024 – August 2024

Montreal, Canada

- Engineered a predictive method using Fourier Neural Operator, Physics-Informed Neural Operator, and DeepONet to approximate flow in porous media, with FNO achieving the highest accuracy of 89%.

### Deep Learning Intern

SMICR Group, Indian Institute of Technology Delhi

June 2023 – June 2024

New Delhi, India

- **Project: Qualitative Prediction of Boundary Layer Thickness via Machine Learning**
- Implemented a **Fourier Neural Operator**-based model to predict boundary layer thickness over a T106A Low-Pressure Turbine blade across varying Mach numbers, achieving **91% accuracy**.
- Captured complex spatial dependencies in boundary layer data using Fourier transforms and deep learning techniques.
- Built conventional **ANN models** to predict skin friction, pressure coefficient, and boundary layer distribution along the blade surface.

## TECHNICAL SKILLS

**Languages:** Python, Julia, MATLAB,  $\text{\LaTeX}$ , SQL

**Frameworks:** PyTorch, TensorFlow, Keras, OpenCV, Streamlit, MLflow, LangChain

**Developer Tools:** Git, VS Code, Google Colab, Jupyter Notebook, Docker

**Libraries:** Pandas, Numpy, Scikit-Learn, Matplotlib, Seaborn, Hugging Face, PySINDy

**Softwares:** PowerBI, Microsoft Excel, Creo Parametric, Ansys, AutoCAD

## PROJECTS

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- **Jupiter Chatbot: AI Assistant for Fintech Queries** [\[Live App\]](#)
  - Developed a context-aware AI chatbot using LangChain, FAISS, and llama-4-maverick, capable of answering user queries based on [Jupiter.Money](#)'s official content.
  - Built an interactive Streamlit UI with memory-based conversations and brand-aligned prompt engineering.
- **Breast Cancer Prediction Web App** [\[Live App\]](#)
  - Developed a Streamlit web app for breast cancer classification using logistic regression (97% accuracy).
  - Integrated radar chart visualization and modular deployment using serialized model and scaler.
- **Semi-Autonomous Water Cleaning Robot [Final Year Capstone Project]** [\[Project Details\]](#)
  - Designed and fabricated a river-cleaning robot with ESP32 and BTS7960-based control system.
  - Conducted CAD modeling and ANSYS simulations to optimize fluid flow around the collector.
- **Fourier Neural Operator for Predicting Flow in Porous Media**
  - Generated synthetic flow simulations using the Lattice Boltzmann Method (15 GB dataset).
  - Trained a Fourier Neural Operator model to predict dynamic flow fields under varying conditions, achieving 89% accuracy.
- **Apple Stock Prediction Using Gaussian Process Regression**
  - Built a GPR-based time series model to forecast stock prices with uncertainty quantification.
  - Applied feature engineering and hyperparameter tuning for improved predictive performance.

## PUBLICATIONS

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- **Singh, V.**, Harursampath, D., Dhawan, S., Sahni, M., Saxena, S., Mallick, R. "Physics-Informed Neural Network for Solving a One-Dimensional Solid Mechanics Problem." *Modelling*, 2024, 5, 1532–1549.  
<https://doi.org/10.3390/modelling5040080>
- Characterization and Detection of Structured False Data Injection in Reinforcement Learning-Controlled Artificial Pancreas Systems [**Submitted to IEEE Transactions on Industrial Informatics**]
- Neural Optimization Machine for Analytical Function Optimization: Application to Auxetic Metamaterial Design [**Ongoing Manuscript**]
- Neural Optimization of Anti-Tetrachiral Auxetic Metastructures for Advanced Engineering Applications [**Ongoing Manuscript**]
- Kolmogorov–Arnold network-based data-driven prognostics for estimating the remaining useful life of aircraft engines in Industry 4.0 [**Ongoing Manuscript**]

## CONFERENCES

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- Physics Informed Neural Network for Modelling Glucose-Insulin Dynamics for Type 1 Diabetes [**Presented at AICOMAS 2025, Paris 17–21 February 2025**]
- Physics-Enhanced Neural Network Approach for Optimizing Re-Entrant Auxetic Structures in Advanced Engineering Applications [**Presented at MSML 2025, Naples, Italy, August 4–8, 2025**]
- An Artificial Intelligence-based Design Framework of Optimal Auxetic Metamaterial Structures [**Accepted at I4AM, Indian Institute of Science, Bengaluru, India, January 8–9, 2026**]
- Design and Development of Piezoelectric Auxetic Energy Harvesting Devices for Engineering Applications [**Accepted at I4AM, Indian Institute of Science, Bengaluru, India, January 8–9, 2026**]

## PATENTS

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- Pseudo-Artificial Pancreas: A Low-Cost AI-Based Insulin Dosage Recommendation System for Type 1 Diabetes [**Patent Filed**]

## AWARDS AND ACHIEVEMENTS

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- Awarded **Merit Scholarship III** for 2023–24 worth **INR 1,59,000** for securing a position in the **top 10%** of students in the Mechanical Engineering Department (MED), TIET.
- **MITACS Globalink Research Fellowship**: Received a fully funded summer research internship at École Polytechnique de Montréal, Canada (June–August 2024), valued at CAD \$9000.
- Awarded **Merit Scholarship III** for 2022–23 worth **INR 1,39,000** for achieving a position in the **top 10%** of departmental student strength at MED, TIET.
- Secured **3rd rank** in MED for academic performance in 2022–23; awarded a **certificate** and a cash prize of **INR 2,000**.