Avaneesh Khadye

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GitHub

Education

2023-2027 **Indian Institute of Technology Bombay** | **Transcript**
Bachelor of Technology: Major in Mechanical Engineering
Pursuing a Dual Minor in Control Systems and Computer Science
GPA **9.33/10** (top 10% of the class)

Scholastic Achievements

2024 Attained Department Rank 11 among 197 students in the Department of Mechanical Engineering
2023 Secured All India Rank 1691 in the JEE Advanced examination among 1,50,000+ aspirants
2023 Secured an 99.29%ile in the JEE Mains exam out of over 1 million candidates.
2023 Secured a perfect score and 100 %ile in Physics in the JEE Mains Exam
2022 Recipient of the KVPY fellowship in the SA stream with an All India Rank 751
2021 Achieved 98.6% in the Indian Certificate of Secondary Education Examinations

Research Interests

Solid Mechanics, Non Linear Dynamics, Control, Reinforcement Learning, Data Science

Research Projects

Aug 2025 – Present **Wrinkling Instability in Thin Elastic Sheets** | Guide: Prof R Ganesh

- Analyzed and approached a nonlinear elasticity-based framework to predict wrinkling onset in thin sheets, using an energy-minimization approach to study instability behavior under applied loading.
- Derived the strain energy functional for large deformation kinematics using nonlinear strain theory.
- Applied variational methods to obtain admissible equilibrium deformation fields under loading.
- Identified and compared admissible wrinkling modes as functions of geometry/material parameters.
- Working on implementing a Ritz-method numerical scheme to simulate wrinkle initiation and post-buckling evolution.

Professional Experience

Summer 2025 **Data Science Intern** | ICICI Prudential Life Insurance

- Performed rigorous EDA for insurance-claim fraud detection using WoE/IV, VIF and correlation analysis to quantify feature relevance, reduce multicollinearity, and guide statistically sound model design.
- Implemented and benchmarked imblearn undersampling methods (ENN, IHT, NCR) for class imbalance
- Trained and tuned classifiers in XGBoost (LogReg,BRF,stacking) optimizing precision–recall.
- Built a fraud propensity scoring model with decile-lift analysis to stratify cases by risk for review.

Courses Taken

Mechanical Engineering: Solid Mechanics and Strength of Materials, Applied Thermodynamics, Heat Transfer, Fluid Mechanics, Thermal and Chemical processing of materials, Analysis and Design of Mechanical Systems, Mechanical Processing of Materials, Structural Materials, Engineering Mechanics, Operations Modeling and Analysis*

Computer Science: Computer Programming and Utilization, Applied Data Science and Machine Learning, Foundations of Intelligent and Learning Agents, Data Structures and Algorithms, Operating Systems

Control: Control Systems, Control of Nonlinear Dynamical Systems*, Microprocessor and Automatic Control Lab*, Distributed Optimization and Machine Learning*

Physics: Non Linear Dynamics, Electromagnetic Theory*, Introduction to Classical Physics

Fundamentals: Calculus, Linear Algebra and Differential Equations, Engineering Mechanics, Biology, Economics

**To be completed by May 2026*

Academic Projects

Fall 2025 **Population Dynamics Simulation & Modeling** | Guide: Prof Punit Parmananda
- Modeled population growth using ODEs, analyzing stability, extinction and carrying capacity.
- Studied non linear dynamics by sweeping birth–death parameters to observe long-term trends.
- Implemented stochastic birth–death simulations via binomial sampling and analyzed noise effects.
- Simulated Lotka–Volterra predator–prey/competition dynamics using phase-plane analysis.

Fall 2025 **Reinforcement Learning Cart-Pole Controller** | Guide: Prof Shivaram Kalyanakrishnan
- Implemented a tabular Q-learning controller for Cart-Pole by discretizing continuous state variables.
- Used TD learning and ϵ - greedy exploration to learn a stable balancing policy with convergent rewards.
- Built a Gymnasium-based simulation pipeline to train, evaluate, and compare learned control policies.
- Tracked learning curves and performance metrics to analyze policy stability and sample efficiency.

Fall 2025 **5 Axis 3D Printing G Code Development** | Guide: Prof Gurminder Singh
- Generated custom multi-axis toolpaths and machine-compatible G-code using Grasshopper 3D.
- Verified toolpaths through dry runs and iterative debugging for coordinated linear and rotary motion.
- Performed axis calibration and motion tuning to improve repeatability and alignment across axes.
- Analyzed system constraints (collisions, clearance, angular mismatch) to guide future printer fixes.

Spring 2024 **Analytical Modeling of Manufacturing Processes** | Guide: Prof S.S. Pande
- Modeled processes like forging, rolling & machining in MATLAB using strain energy formulations.
- Simulated time-dependent process dynamics using MATLAB ODE solvers to study deformation trends.
- Performed parameter studies to quantify the effect of inputs on material flow, loads, and power.
- Applied numerical optimization to improve efficiency by minimizing energy under practicality constraints.

Fall 2024 **Microhardness Analysis of Steel** | Guide: Prof Soham Mujumdar
- Compared properties of 316L steel produced via Metal Laser Deposition(MLD) vs traditional extrusion.
- Performed Vickers microhardness test to quantify property variations due to the manufacturing route.
- Conducted metallographic sample preparation including aqua regia etching of 316L specimens.
- Examined grain structure under microscopy to link MLD processing to material properties.

Fall 2024 **Cryptanalysis of Vernam Pad** | Guide: Prof Sruthi Sekar
- Developed a Python program to decrypt Vernam Cipher with multi-time pad using frequency analysis.
- Implemented statistical techniques to identify key patterns and accurately recover plaintext.
- Enhanced decryption accuracy by analyzing character frequencies and applying cosine similarity.

Spring 2023 **Self-Built Universal Testing Machine**| Guide: Prof Krishna Jonnalgadda
- Designed a functional UTM using gears, lead screws, and an IR sensor for extension measurement.
- Built the instrumentation using Arduino Uno, op-amp and Schmitt trigger circuits for reliable sensing.
- Implemented real-time data acquisition, plotting the stress–strain curve to validate machine performance.

Technical Skills

Languages Python, C++, Java, R, MATLAB, SQL, LaTeX

Software ANSYS, Abaqus, Solidworks, Fusion360, Arduino IDE, RStudio, MySQL, MATLAB

Packages Pytorch, Scikit-Learn, Gymnasium, NumPy, Pandas, Matplotlib

Activities

2023 Taught JEE level Mathematics to students from economically challenged backgrounds as a volunteer for Ummeed NGO under the National Service Scheme(NSS).

2024 Taught English to underprivileged children as a volunteer for Team LCCW under the NSS

2025 Selected as a member of the Inter-IIT Cultural Meet contingent for Quizzing to represent IIT Bombay in national-level competitive quiz events.

2023-25 Traveled across Vietnam, Cambodia, and India (Ajanta–Ellora, Hampi, Elephanta) to explore and study rock-cut caves, temples, and historical stone architecture.