Om Prabhu

prabhu.om@iitb.ac.in omprabhu31
http://omprabhu31.github.io/
https://www.linkedin.com/in/omprabhu31/

All the links appearing below are also available at https://omprabhu31.github.io/cv.

I am a fourth year undergraduate at IIT Bombay, pursuing a dual degree in **Mechanical Engineering** and minor in **Systems & Control Engineering**. My research interests are in the field of **robotics**, especially in **vision-based perception for autonomous vehicles** and **deep learning for achieving human-like cognition**. I am also interested in **optimization** and **deep learning**. I recently completed my internship at SEDEMAC Mechatronics where I worked in research & development. I am currently **looking for a research internship** in some of these areas - however, I am completely open to working in other research areas as well.

Education

2019 – 2024 **Indian Institute of Technology Bombay, India** 8.13/10 GPA
BTech in Mechanical Engineering with MTech in Computer Integrated Manufacturing
Minor in Systems & Control Engineering

2017 – 2019 **Sathaye College of Science, Commerce and Arts** 89.23%
Higher Secondary, Maharashtra HSC

2017 **Ajmera Global School** 95.38%
Junior Secondary, Cambridge IGCSE

Work Experience

2022 **Research & Development Intern**
Supervisor: Prajesh Pandey | R&D Engineer, SEDEMAC Mechatronics Pvt Ltd

Completed a project on stress analysis and selection criteria of rivets and threaded fasteners. The project involved carrying out a preliminary literature review of standard manufacturing guidelines & material selection criteria and behaviour of fastening joints under eccentric loading conditions. These concepts were later put to use to perform stress analysis of rivets in non-standard part geometries, the results of which were finally presented to the manufacturing team.

Research Projects

2021 **Humor Detection using BERT Sentence Embedding**
Guide: Prof. Balamurugan Palaniappan | Industrial Engineering & Operations Research, IIT Bombay

Read *ColBERT: Using BERT Sentence Embedding for Humor Detection* and analyzed pre-existing models discussed in supporting literature. We initially replicated these models and verified their accuracy against extensive online datasets. We then modeled our own version using convolutional layers instead of dense layers followed by testing & comparison against existing models.

LU Decomposition: A Timing Study using OpenMP and CUDA
Guide: Prof. Shivasubramanian Gopalakrishnan | Mechanical Engineering, IIT Bombay

In this project, we studied three methods of LU decomposition of matrices - gaussian elimination, Doolittle algorithm and Crout's method. We then parallelized the three algorithms using OpenMP & CUDA and carried out a timing study varying the matrix order and number of CPU threads (for OpenMP implementation only).

The following links can be used to access the project report and presentation.

Course Projects

2022 **Shoe-stopper: Step Counting using Piezoelectricity**
Guide: Prof. Ramesh Singh | ME 423: Machine Design

For this course project, we brought together our previous learnings of stress analysis, material selection criteria, thermodynamics, etc in order to design a product of our choice. Apart from mechanical knowledge, the design of the piezoelectric shoe prototype also involved several electrical engineering aspects as well as knowledge of Arduino programming. The projects were displayed in an exhibition which was attended by several esteemed professors from the institute.

The following links can be used to access the project report and code.

Operations Research in Air Traffic Flow Management Systems
Guide: Prof. Avinash Bhardwaj | ME 308: Industrial Engineering and Operations Research

In this project, we discussed the problem of air traffic flow management on a high level and analyzed some pre-existing AFTM models in supporting literature. We also formulated our own mathematical model, loosely based on the one presented in *Disaggregation Method for an Aggregate Traffic Flow Model*, modifying the constraints as required to obtain an objective function, and finally implementing the model in AMPL.

The following links can be used to access the project report and presentation.

2021 **Manufacturing Process of a Clock**
Guide: Prof. Deepak Marla | ME 338: Manufacturing Processes II

In this project, we analyzed the general manufacturing pipeline and carried out research regarding the design, materials & components, and cost analysis for a clock. We then studied, in much greater detail, the processes, machines & equipment involved in the manufacturing of a clock.

The following links can be used to access the project report and presentation.

Measuring Seismic Movement Using Accelerometers
Guide: Prof. Dipanshu Bansal | ME 226: Mechanical Measurements

This project involved studying the working principles of a seismic accelerometer sensor and formulating a model to obtain its characteristic equation. Following this, we derived the output of the system and carried out error analysis for step and sinusoidal inputs. Finally, we used the resulting equations to calculate the natural frequency of the system and its associated phase error corresponding to a given operating frequency and amplitude error.

The following link can be used to access the project report.

Reading Projects

2022 **Stabilizing Angular Momentum & Attitude Equations of Rigid Bodies using Torques**
Guide: Prof. Ravi Banavar | SC 618: Analytical and Geometric Dynamics

Read *Stabilization of Rigid Body Dynamics by Internal and External Torques* by *Bloch, Krishnaprasad, Marsden, Sanchez de Alvarez* and learnt about rigid bodies with external torques and attitude spin stabilization of dual spin satellites. We also analysed various methods of geometric mechanics such as energy-momentum algorithms & energy-Casimir method, and correcting attitude drift.

The presentation for the same can be found here.

Reading Projects (continued)

2021 **Extended Kalman Filter on Lie Groups**
Guide: Prof. Ravi Banavar | Systems & Control Engineering, IIT Bombay

Read *Intrinsic Extended Kalman Filter on Lie Groups* by *D. H. S. Maithripala, Ravi N. Banavar* and learnt about discretization of the Kalman Filter on lie groups and its application to rigid body motion. We also implemented a basic Kalman Filter algorithm for a toy problem to calculate the angular velocity for a simple pendulum without differentiating its angular displacement.

The code for the same can be found here.

Cohesive Zone Model for Adhesion of Cylinders
Guide: Prof. Tanmay Bhandakkar | Mechanical Engineering, IIT Bombay

Read *A cohesive zone model for the adhesion of cylinders* by *J. M. Baney, C. -Y. Hui* and studied the mechanics of contact between long cylinders. We also studied the Gauss-Chebychev quadrature model for approximating numerical integrals and implemented it in MATLAB to compute the pressure in the contact region due to Dugdale cohesive traction as suggested in the above paper.

Relevant Coursework

Mechanical Machine Design, Optimization, Industrial Engineering & Operations Research, Microprocessors & Automatic Controls, High Performance Scientific Computing, Manufacturing Processes, Heat Transfer & Applied Thermodynamics, Fluid Dynamics, Structure of Materials

Control Systems Analytical & Geometric Dynamics, Linear & Nonlinear Systems, Signals & Feedback Systems, Mathematical Structures for Control

Other Operations Analysis, Introduction to Number Theory & Cryptography, Deep Learning: Theory & Practice, Introduction to Numerical Analysis, Linear Algebra

MOOC Courses
Machine Learning (Stanford University, Coursera) - Cerfiticate
R Programming (The Johns Hopkins University, Coursera) - Certificate
Data Science: Visualization (Harvard University, edX) - Certificate
Data Science: Probability (Harvard University, edX) - Certificate
Data Science: Inference & Modeling (Harvard University, edX) - Certificate

Teaching and Mentorship

2020-2021 **Undergraduate Teaching Assistant**
Entrusted with the responsibility of being a Teaching Assistant at IIT Bombay for the course ME 119: Engineering Graphics & Drawing under Prof. Neeraj Kumbhakarna. This involved

- conducting weekly live lab sessions for a batch of 30 students, guiding them through the process of CAD modeling in AutoCAD, and helping them clear conceptual doubts through personal interaction,
- collaborating with professors & fellow teaching assistants to ensure proper conduct of the course timely correction of semester examination answer sheets.

2019-2020 Completed 80 hours of community service by teaching underprivileged students in NGOs through personal interaction and creation of educational videos as a volunteer of National Service Scheme, IIT Bombay

Academic Achievements

2020 — Secured a change of branch (**top 11% students**) to Mechanical Engineering due to exemplary academic performance in freshman year.

2019 — Scored **99.63** percentile among 1,000,000 students in **JEE (Mains) 2019**. The JEE is an all India standardized test for admission to various highly coveted technical undergraduate programs.

— Achieved All-India Rank **1670** out of 169,000 students in **JEE (Advanced) 2019**.

2017 — Awarded the **World Topper** certificate for scoring **100%** in Extended Mathematics in the March 2017 session of Cambridge IGCSE examinations.

2016 — Secured a **Top 30** rank in the 2018 Mathematics Olympiad conducted by Mathematics Association, IIT Bombay.

Technical Skills

Languages — LaTeX, Python, R, C#, C++, Sage

Tools — MATLAB, ANSYS Fluent, Abaqus, AutoCAD, SOLIDWORKS, GitHub

Extracurricular

2021 — **Junior C# Programmer Intern**
Guide: Mohammed Imtiyaz | Workplay Inc.

Worked with a close-knit group of employees at a game development startup geared towards creating interactive experiences for corporate clients. The role involved programming in C#, modifying input systems & UI elements, code profiling, and managing project releases in GitHub.

Junior Programmer Pathway, Unity Learn
Specialized set of course modules offered by Unity Technologies

The Unity Junior Programmer Pathway validates skills and competencies to be a proficient programmer writing scripts in C# to create interactive experiences in the Unity editor. This involved

- studying and implementing object oriented programming principles in C# for instantiating game objects and modifying their components,
- utilizing the Unity API to create scene flows, implement data persistence across scenes and user sessions, and profile code to diagnose & debug exceptions.

The badge for the same can be found here.

2019 — Volunteered in the Travel & Transport department of the 2019 International Conference on Energy Advances and Research and handled responsibilities involving transport arrangements & formalities for esteemed research delegates from all over the world.