Pruthak Utpal Joshi

Curriculum Vitae

pruthakj@g.ucla.edu, pruthakjoshi@gmail.com
pruthakjoshi.github.io

Education

University of California, Los Angeles **2022 - Present**
M.S. in Mechanical Engineering *Los Angeles, USA*
GPA: 3.9/4

Indian Institute of Technology Bombay **2017 - 22**
B.Tech. + M.Tech. (Dual Degree) in Mechanical Engineering *Mumbai, India*
Specialization: Computer-Aided Design and Automation
Minor: Industrial Engineering and Operations Research
CGPA: 9.12/10, GRE: Q: 170 V:158 AWA: 4.0/6, TOEFL: 116/120

Research Experience

Design of MR-compatible Robotic System for Abdominal Interventions **September 2022 - Present**
Advisor: Prof. Tsu-Chin Tsao, Mechanical and Aerospace Engineering Department, UCLA

- Designing a 3-DoF MR-compatible robot teleoperated abdominal interventions with human-robot collaboration
- Developing a hydrostatic actuation and transmission network to create MRI-safe and low friction actuation
- Translating the system requirements to engineering parameters to develop design and control strategies
- Developing a dynamic tissue phantom with torso dimensions for evaluating new interventions in targets during motion

Vibration Analysis for Modeling the Characteristics of Surface Roughness During Milling **December 2022 - Present**
Advisor: Prof. Tsu-Chin Tsao, Mechanical and Aerospace Engineering Department, UCLA

- Collecting vibration and power data with various machining parameters for developing a model for predicting the vibration and power consumption during milling operations
- Analyzed the effect of various machining parameters such as spindle speed, depth of cut, and feed rate on vibration

Modelling and Characterization of a Soft Robotic Finger | Master's Thesis **May 2021 - June 2022**
Guide: Prof. Abhishek Gupta, Department of Mechanical Engineering, IIT Bombay

- Perused existing literature about the different manufacturing & actuation methods and sensors used in soft robotics
- Analysed two models for a 3-link, 3-joint soft robotic finger for evaluating the fingertip position
- Experimentally verified the accuracy of the RRR model in predicting the fingertip position across various trajectories
- Established the various physical parameters of the setup required to perform experiments
- Corroborated the dynamic behavior of the finger through image processing and simulations in MATLAB

Design and Development of Setup for Characterization of Liquid Bridge Separation **May 2019 - July 2019**
Guide: Prof. Prasanna Gandhi, Department of Mechanical Engineering, IIT Bombay *Research Project*

- Performed iterative analysis to dimensionalize parallelogram compliant mechanism to satisfy given specifications
- Designed the adaptive setup to get the tip displacement in the 100 μm range for an applied load in the order of mN
- Incorporated a modification to achieve the displacements in a desired range based on the accuracy of the sensors used
- Modelled design iterations in SolidWorks to arrive at the final design, and prepared drawings for fabrication

Work Experience

Engineering Intern | Lear Corporation **April 2020 - June 2020**
Global automotive technology leader in Seating and E-Systems | Ranked 147^{th} in 2019 Fortune-500 rankings

- Delivered a design guideline by benchmarking 10+ side valance designs currently in practice using a2mac1
- Analyzed the properties of 15+ plastic materials used in the automotive industry and suggested a material most suitable for side valance manufacturing based on parameters including density, yield stress, and melt flow rate
- Performed calculations for comparing the strain generated through bending and compression due to impact load in the ribbing patterns of the automotive side valance to arrive at a structure with optimal shape and dimensions
- Studied the frontal and side impact tests performed on vehicles to visualize the failure modes of the side valance
- Designed an Excel based calculator for calculating deformation in the ribs based on the input design variables

Technical Projects

Subsystem Head: Robotic Arm | IITB Mars Rover Team **April 2019 - March 2020**

Faculty Advisor: Prof. Guruprasad PJ, Department of Aerospace Engineering, IIT Bombay *Student Technical Team*

- Led the design, analysis, optimization, and manufacturing of the robotic arm for student design competitions
- Designed a 3-link, 6-DOF robotic arm capable of reaching heights upto 1.2m and lifting upto 5 kg weights
- Revamped the gripper to a 3-fingered design based on lead screw mechanism having a 60 mm grasping span
- Achieved a 30% weight reduction and 5% increase in strength by using carbon fiber links over Al and SS alloys
- Represented the team in Manufacturing Today Conference and Awards and other technical expositions

Nonlinear Dynamics and Stability Analysis of Vehicle Plane Motions **January 2021 - April 2021**

Guide: Prof. Dnyanesh Pawaskar, Department of Mechanical Engineering, IIT Bombay | Report *Course Project*

- Studied the planar motion of a vehicle using the joint-point locus approach and simplified Pacejka tire model
- Analysed the vehicle's stability and behavior over different vehicle speeds, sideslip angles, and steering angles
- Replicated the results of the publication using MATLAB for a better understanding of the mechanics of the problem

Floating Waste Cleaning Machine **July 2020 - November 2020**

Guide: Prof Shantanu Tripathi, Department of Mechanical Engineering, IIT Bombay | Report *Course Project*

- Proposed a design for a machine for collecting floating waste using a conveyor belt and waste compression mechanism
- Designed the arms for aggregating waste to be sent for further processing and modelled the machine in Fusion 360
- Studied and estimated the possible impact of the machine in cleaning the water bodies through market research

Optimization of Vaccine Distribution **January 2021 - April 2021**

Guide: Prof. Abhijit Gogulapati, Department of Aerospace Engineering, IIT Bombay | Report *Course Project*

- Mathematically formulated a problem for optimizing the number of vaccines delivered to 3 states across three weeks from 2 suppliers taking into account the demographic data of states and the vaccine manufacturing capacity
- Employed the Simplex algorithm to get optimal solution, and benchmarked it against SciPy's simplex algorithm
- Compared the computational time and overall cost for Simplex, Affine Scaling, and Genetic algorithms
- Obtained the estimates from our implementation to within 3% of that of the actual government allocations

Pressure Controlled Skateboard **May 2018 - June 2018**

Institute Technical Summer Project *IIT Bombay*

- Ideated and built an electric skateboard controlled by the pressure difference generated by the weight of the rider
- Integrated Force Sensitive Resistors (FSR) with Arduino UNO to generate input signal for L298N motor driver
- Designed the skateboard to have a capacity to carry upto 70 kg weights and climb slopes upto 15° angle

Leadership and Mentoring Roles

Team Leader | IITB Mars Rover Team **April 2020 - April 2021**

A cross functional team of 40+ students which designs and fabricates a semi-autonomous rover for the University Rover Challenge (URC), an international robotics competition conducted by The Mars Society annually at Utah, U.S.A., and Indian Rover Design Challenge, conducted by Mars Society South Asia

- Led the team to 4th position in IRDC-2020 among 28 international teams from 7 countries (best position till date)
- Raised funds and managed resources worth ₹1.38 Million+ acquired through the institute STP Committee
- Secured sponsorships from SolidWorks and ANSYS worth ₹150,000+ to bolster the entire designing process
- Employed Gantt charts and GrabCAD for maintaining the product design and development timeline of the rover
- Ensured effective system integration of the Mechanical, Electrical & Bio-Sciences subsystems on the rover

Institute Student Mentor **April 2019 - June 2021**

Institute Student Mentor Programme *IIT Bombay*

- Selected for two consecutive years as a mentor out of 300+ applicants based on SOP, peer reviews, and interviews
- Guided 24 freshmen towards their academic and co-curricular pursuits and helped them adjust to college life
- One of the only 13 students among the entire third year batch chosen on the basis of all-round performance
- Recipient of the ISMP Special Mention award for exemplary contributions as a part of Student Mentor Programme

Department Academic Mentor **April 2019 - April 2021**

Department Academic Mentorship Programme *IIT Bombay*

- Part of a 32 ['19-'20] and 39 ['20-'21] member team mentoring 150+ students in with their academic concerns
- Guided 10 sophomores through comprehensive planning to help them overcome academic and personal challenges
- Assisted a student under Academic Rehabilitation Programme in planning and managing his academic work

Teaching Assistant

Microprocessors and Automatic Control *July 2021 - September 2021*

- Part of a TA team entrusted with the responsibility of tutoring 180+ students and assisting in evaluations

Microprocessors and Automatic Control Lab *September 2021 - Present*

- Part of a 6 member TA team entrusted with the responsibility of tutoring a batch of 90+ students in Lab sessions

Engineering Mechanics *January 2019 - April 2019, January 2020 - April 2020*

- Assisted a batch of over 50 students in problem solving and clarification of concepts through regular tutorials

Convener **April 2018 - March 2019**

Maths and Physics Club *IIT Bombay*

- Part of a group involved in the organization of events fostering to the enthusiasm of students in Physics and Maths
- Organized institute-wide quizzes, talks, and group discussions catering to 500+ students on campus

Relevant Coursework

Design and Manufacturing	Machine Design, Reliability Modelling and Analysis for Engineering Systems (ongoing), Finite Element Method, Optimization for Engineering Design, System Modelling and Simulation, Acoustics and Hearing, Kinematics and Dynamics of Machines, Computer Integrated Manufacturing, Manufacturing Processes I+II
Robotics and Controls	Linear Dynamic Systems, Digital Control of Physical Systems, Probability and Stochastic Processes in Dynamical Systems, Linear Optimal Control, Stochastic Estimation, Advanced Digital Control for Mechatronic Systems, Robotics, Design of Mechatronic Systems, Intelligent Feedback and Control, Systems Theory, Control of Nonlinear Dynamical Systems, Microprocessors and Automatic Control
Others	Mathematical Optimisation Techniques, Optimization Models, Computer Graphics and Product Modeling, Introduction to Numerical Analysis, Introduction to Electrical and Electronics Circuits, Economics, Psychology, Linear Algebra, Differential Equations

Scholastic Achievements and Accolades

- Recipient of UCLA Division of Graduate Education Fellowship **'22-'24**
- Secured an All India Rank of 425 among 0.17 million candidates in JEE Advanced **2017**
- Achieved an All India Rank of 191 among 1.2 million candidates in JEE Main **2017**
- Recipient of the Institute Academic Prize for securing the highest average SPI in the Mechanical dept. **2020-2021**
- Ranked 6^{th} in the Mechanical Engineering Department on the basis of academic performance

Additional Information

Programming Skills: C++, Python
Modeling and Analysis Software Skills: SolidWorks, ANSYS, ADAMS, AutoCAD, Fusion 360
Scientific Tools: MATLAB, Scilab, NumPy, pandas, Keras, Arduino, XEP100, TIVA

Extra-Curricular Activities

Sports	• Part of a group of 24 students selected to receive a year long training in **Lawn Tennis** through National Sports Organisation, IITB *['17-'18]* • Participated in the **Institute Tennis Open** Doubles tournament among 64 players *['18]*
Social	• Tutored underprivileged students from class **6^{th}-10^{th}** in school level mathematics as a part of Abhyasika, IITB *['19-'20]*