Shrita Singh **17D170009**
Energy Science and Engineering **Third Year Undergraduate**
Indian Institute of Technology Bombay **Female**
Specialization: Energy Systems Engineering **DOB: 17/02/2000**

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2017-22	8.14
Intermediate/+2	CBSE	Ryan International School	2017	93.20
Matriculation	CBSE	Apeejay School, Kharghar	2015	94.3

Publications

- Riya, **Shrita Singh** et al, "Closed Loop Simulation for Attitude Control of Nano-satellite" in *International Conference on Small Satellites and Systems*, Hyderabad, India, 2019

Scholastic

- Awarded **Undergraduate Research Award** for work applying **optimal control** on plug-in hybrid cars *('19)*
- Pursuing a **minor** in **Systems and Control Engineering** *('18 - Present)*
- Achieved a rank of **1415** in JEE Main 2017 among **1.2 million candidates** *('17)*
- Secured an **All India Rank** in the **top 1.09%** in JEE Advanced 2017 among **2.2 lakh students** *('17)*

Workshops

Non Linear Control and Robotics Workshop (March '19)

Sri Lanka Technological Campus, Padukka, Sri Lanka

- Introduction to nonlinear controllabillity, rigid body control, feedback linearisation and observer design
- Exposure to nonlinear control switching logic for control of inverted pendulum and a simplified helicopter model

Helicopters Lab (May '19)

Helicopter and VTOL Lab, Aerospace Department, IIT Kanpur

- Visited Helicopter lab to understand and gain hands-on experience on dynamics and control of aerial vehicles
- Simulated position & attitude estimation of a quadrotor using real sensor data & **Passive Complementary Filter** on MATLAB and developed understanding of implementing the code on **Pixhawk Flight Controller**

Technical Projects

Optimal Control on Hybrid Vehicles | URA01 (Nov '18 - Present)

Guide: Prof. Ravi Banavar, Department of Systems and Control, IIT Bombay

- Surveyed literature on optimization, hybrid vehicles and optimal control in both continuous and discrete time, and **formulated an optimal control problem** for minimizing fuel consumption of the Chevrolet Volt
- Built a detailed, **modular closed loop simulator** on **Simulink** for testing different control strategies
- Used **quasi-static models** for generator, motor, engine & experimentally verified **dynamic model** for battery
- Implemented **longitudinal dynamics** of the vehicle in simulator for various driving cycles and road grades
- Expressing and solving the optimization problem in discrete time using the **CasADi framework** for optimal control problems and pursuing a solution via the **discrete time Pontryagin's maximum principle**

Heliostat Tracking and Control (Nov '18 - Present)

Guide: Prof. Shireesh B Kedare, Dept. of Energy Science and Engineering, IIT Bombay

- Conducted literature review in solar geometry, solar radiation patterns, solar thermal systems and **heliostat tracking algorithms** which implement **feedback control**
- Devised a tracking logic using solar geometry and **iterative methods** and simulated it in **MATLAB** for an entire solar year at different latitudes to determine effectiveness and accuracy
- **Prototyped** a **Heliostat model** using a mirror, stepper motors, worm gears and motor drivers and **implemented** a **tracking logic** on the Heliostat model using Arduino Mega microcontroller
- Currently working on using IMU data with a **passive complementary filter** and cameras for implementing **feedback control**

Advitiy, Student Satellite Team, IIT Bombay (Feb '18 - Jan '19)

Team Member, Attitude Determination and Controls Subsystem
Second Student Satellite, technically advanced and efficient version of the first, Pratham

- Conducted literature survey on **nonlinear adaptive controllers** for satellite control via **magnetic actuation**
- Tested a **PID** controller by running real time **On Board In Loop Simulations** in **python** and interfacing the software with a **microcontroller**, used to verify stabilization of the satellite's attitude
- Simulated power generated in orbiting 1U satellite in **python** to estimate the **power budget** of the satellite
- Implemented **UART communication protocol** between an **ATmega micro-controller** and a computer for the exchange of health monitoring data and commands
- Contributed in development of **quality assured modular closed loop simulation frame-work** for attitude dynamics of satellite by developing codes, test-codes and maintaining Readme files and QA reports

Six DOF Stewart platform (May '18 - July '18)

Institute Technical Summer Project
Student Technical Activities Body, IIT Bombay

- Built a Stewart Platform that uses **parallel manipulators** to achieve six degrees of freedom of movement
- Employed **inverse kinematics** to calculate control input for the servos for the desired position and orientation
- Developed the system using **servo motors** and **ball bearing actuators** driven via **Arduino** and achieved the aim of the project with the error of **5 degrees** in orientation and **2 cms** in position

Energy Assessment of Sri Lanka (Feb '19)

Guide: Prof. Anish Modi, Dept of Energy Science and Engineering, IIT Bombay (Course Project)

- Modelled primary & end-use energy composition by source and sector using **Sankey** and **PECSS Diagram**
- Speculated future energy scenario and suggested impactful reforms, taking into account current resources, technological advancements and **Intended Nationally Determined Contributions (INDCs)**
- Studied **present energy scenario**, the various policies in place, and how growth in sectors like transportation, and residential, might pose a constraint to their 2050 targets for **decarbonisation** of economy

Hobby Projects

Line Follower (Feb '18)

Electronics and Robotics Club, IIT Bombay

- Designed an autonomous robot using a **PID controller** that follows a given path and implemented the control algorithm on an Arduino using IR sensors and differential mechanism for actuation

Remote Controlled Plane (Sep '17)

Electronics and Robotics Club, IIT Bombay

- Learnt dynamics of flight to design the mechanical body of the plane and used Electronic Speed Controller, Servos, BLDC Motor, RF Module to control and manoeuvre the plane

Automatic Lighting System (Feb '18 - April '18)

Guide: Prof. Rangan Banerjee, Dept of Energy Science and Engg, IIT Bombay (Course Project)

- Built an accurate counter system using **Arduino** and **LDRs** tracking the number the people inside a room so that its appliances can be automatically controlled via **relays**
- Analysed the annual energy and cost savings and achieved a **payback period** of **8 months** for the device

Chain Reaction Game (Jan '18 - April '18)

Guide: Prof. Krishna S Narayan, Department of Computer Science, IIT Bombay (Course Project)

- Created a **simulation** in C++ which achieved accurate results of a chain reaction game played between **multiple players** via **command line** and displayed the final state of the game after each term

Technical Skills

Programming	Atmel Studio (ATmega), Arduino IDE, C++, Python, MATLAB
Simulation and CAD softwares	AutoCAD, Simulink, SolidWorks

Relevant Courses Undertaken

Systems and Controls	Geometric and Analytic aspects of Optimal Control, Linear and Nonlinear Control*, Signals and Systems, Mathematical Structures for Systems and Control
Mathematics	Calculus, Linear Algebra, Differential Equations, Data Analysis and Interpretation, Introduction to Numerical Analysis
Mechanical Engineering	Solid Mechanics, Material Science, Engineering Graphics, Workshop Practice
Energy Science	Solar Energy for Industrial Process Heat*, Thermodynamics, Transport Phenomena, Reaction Engineering and Combustion*, Thermo-Fluid Devices*, Renewable Energy Technologies, Energy Economics and Environment
Electrical Engineering	Power Electronics*, Electrical Machines, Basic Electrical & Electronics Engineering

** to be completed by Nov '19*

Extra-Curricular Activities

- Volunteered to tutor 9th and 10th graders for three months under Asha NGO in collaboration with **NSS** *('19)*
- Received Merit in grade 1 to 3 of Electronic Keyboard by **Trinity College of London** *('11)*
- Wrote reviews of restaurants and ideated themes for the Powai Leisure Map section of **Undergraduate Freshers Newsletter 5.2** under **Insight, IIT Bombay** *('18)*
- Sports :
  - Completed a distance of 13.5 kms in 12 hours at **Swimmathon, IIT Bombay 2018** *(May '18)*
  - Represented Hostel 15 in inter-hostel Swimming **General Championship** & **Triathlon** event *('18)*
  - Among 32 students selected for Swimming **National Sports Organisation** *(June '18)*
- Industrial Visits : *('18)*
  - Naval Dockyard - Learnt about **gas turbine engines** in military ships
  - Reliance Metro Control Centre, Mumbai - Gained insight into the **control of metro trains**
  - IITB Powerhouse - Gained insight into **power distribution systems**, and analyzed the structure and working of **relays** and **transformers**