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)*
- Pursuing **Modern Robotics: Mechanics, Planning, and Control Specialization** offered by Northwestern University online via Coursera *('19 - Present)*

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
- Solving the optimization problem in discrete time via **multiple shooting method** through the **discrete time Pontryagin's maximum principle** using the **CasADi framework** for optimal control problems

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

State Estimation of Power Systems (Jan '20 - March '20)

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

- Conducted literature review of **state estimation algorithms** for linear and **nonlinear power systems**, like method of least squares, kalman filtering and iterative methods for the same.
- Developed a state estimation model for the **IEEE-14 Bus system** using iterative methods for regression analysis on MATLAB for two cases, PMU data available and PMU data unavailable.
- Performing **observability analysis** of the system buses and trying to find the optimal number of PMUs to be placed using **integer linear programming optimization technique**.

Heliostat Tracking and Control (Nov '18 - July '19)

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

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 a bot using **PID controller** based on differential mechanism that follows a given path using **Arduino**

Remote Controlled Plane (Sep '17)

Electronics and Robotics Club, IIT Bombay

- Designed the mechanical body and used Electronic Speed Controller, Servos, RF Module to control 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 automatic lighting system using **Arduino**, **LDRs**, lasers and **relays** for a typical hostel room

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++** of a chain reaction game played between **multiple players** via **command line**

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, Advanced Process Control*, Control and Instrumentation*, 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	Kinematics and Dynamics of Machines*, Solid Mechanics, Material Science, Engineering Graphics
Energy Science	Solar Energy for Industrial Process Heat, Thermodynamics, Transport Phenomena, Reaction Engineering and Combustion, Thermo-Fluid Devices, Electrochemistry*, Renewable Energy Technologies, Energy Economics and Environment
Electrical Engineering	Power Generation and System Planning*, Electrical Energy Systems*, Power Electronics, Electrical Machines, Basic Electrical & Electronics Engineering

** to be completed by April '20*

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**