

Shrita Singh

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EDUCATION

Indian Institute of Technology, Bombay, Interdisciplinary Dual Degree (B.Tech + M.Tech) 2017-2022

Master's Degree: Process Systems Engineering, [Department of Chemical Engineering](#), GPA: 9.2/10

Bachelor's Degree: [Department of Energy Science and Engineering](#), **Combined GPA:** 8.85/10

Minor Degree: [Department of Systems and Control](#)

PATENTS AND PUBLICATIONS

- Shumon Koga, **Shrita Singh**, et al, "Path Refinement for Obstacle Avoidance", [JP Patent H1240381JP01](#), 2024
- Rintaro Imamura, **Shrita Singh**, et al, "Prediction for Obstacle Avoidance", [JP Patent H1240478JP01](#), 2024
- Shrita Singh**, Ashutosh Singh, Sachin Patwardhan, "Development of Block Iterated Extended Kalman Filter for Recursive Estimation of ARMAX Model Parameters", [Indian Control Conference \(ICC\)](#), 2023
- Shrita Singh**, Kunal Kumar, Sachin Patwardhan, "Development of Block Oriented Recursive and Constrained Parameter Estimation Schemes for ARMAX Models", [IFAC Symposium on Dynamics and Control of Process Systems](#), 2022
- Riya Singh, **Shrita Singh**, et al, "Closed Loop Simulation for Attitude Control of Nano-satellite", [Advances in Small Satellite Technologies, Springer](#), 2020 and [International Conference on Small Satellites and Systems](#), 2019

AWARDS AND ACHIEVEMENTS

- Awarded **R.G. Manudhane M. Tech. Student Excellence Award** for outstanding graduate thesis | IIT Bombay [2022]
- Awarded **Undergraduate Research Award** for preliminary research efforts | IIT Bombay [2019]

RESEARCH EXPERIENCE

Behaviour Planning for Autonomous Vehicles Oct 22 - Aug 25

AI Researcher, [Cooperative Intelligence Research Domain](#), Honda R&D

Tokyo

- Conducted cooperative behaviour planning research and development for Honda's next level-3+ self-driving vehicle
- Designed a **model predictive control** speed planner for reliable braking behavior (*Honda Showcase 2023*)
- Developed an **A* graph search based path planner** to conduct lane changes and obstacle overtakes
- Developed a **cooperative agent prediction** algorithm that considers predicted ego behaviour to improve traffic flow
- Conducted on-road tests, ensuring the algorithms' reliability and performance in real-world conditions

Block Data Driven System Identification Schemes

Jan 21 - June 22

Master's Thesis: [Prof. Sachin C. Patwardhan](#), Dept of Chemical Engineering

IIT Bombay

- Designed modeling schemes for tracking slow varying system parameters on-line from blocks of input-output data
- Updated **black-box dynamic model parameters** (ARX, OE, ARMAX) recursively using sequential least squares
- Developed **3 novel methods** incorporating model stability constraints via **nonlinear constrained optimization**
- Designed **Extended Kalman Filter** based approach with forgetting factor for tracking sudden parameter variations
- Tested on simulated and **experimental data** with tracking errors below **5%** for ARX, **10%** for OE and ARMAX

Adaptive Model Predictive Control

Jan 21 - June 22

Supervised Learning Project: [Prof. Sachin C. Patwardhan](#), Dept of Chemical Engineering

IIT Bombay

- Implemented real-time adaptive model predictive control (MPC) for lab setups using designed block update schemes
- Developed **ARX, ARMAX models** for a nonlinear temperature lab using experiment data, MATLAB SysId Toolbox
- Constructed a **kalman predictor** using models with update schemes, reducing MPC output error sum by **18%**

PROFESSIONAL EXPERIENCE

Applied Intuition | Behaviour Planning for Trucking Autonomy

Aug 25 - Present

Behaviour Planning Engineer, [Trucking Autonomy Team](#)

Tokyo

- Building planning architecture for training end-to-end autonomy for autonomous truck driving on highways
- Designing constrained iLQR based trajectory optimization enabling learning based planning while ensuring safety
- Contributing to data pipeline for training machine learning based planner for highway truck driving contexts

ABB | Learning Based Control
Research and Development Intern, [Corporate Research Center](#)

June - Aug 2021
Bangalore

- Developed a controller based on **approximate dynamic programming** to learn from past control behaviour
- Deployed on a double integrator system using **value iterated** closed-loop data achieving **44%** rise-time improvement
- Developed **data availability, reliability** metrics to ensure controller performance tested on **40+** simulated runs

Capgemini SE | Machine Learning and Data Analytics Tool Development
Junior Data Scientist, [Digital Acceleration Centre](#)

May-July 2020
Bangalore

- Analyzed company query data using ML and NLP techniques using **feature engineered** variables for early resolution
- Defined incident categories from cleaned text data using **word embedding** and **topic modeling algorithms**
- Tested number of incidents prediction via **XGBoost Regression** and **LSTM Network** improving F1 score by **4%**

Student Satellite Team | Advitiy Nano-Satellite
Team Member, [Attitude Determination and Control Subsystem](#)

Feb 2018 - Feb 2019
IIT Bombay

- Developed a **modular simulation frame-work** of satellite dynamics, external environment for controller testing
- Tested a **PID controller** by running **On Board In Loop Simulations** on Arduino to assess real-time performance
- Simulated **solar power available** to an orbiting 1U CubeSat to estimate electrical system power budget

TECHNICAL PROJECTS

Economic Dispatch and State Estimation of a Grid System

Aug-Oct 2020

- Developed a system model for **IEEE-9 Bus system** using **Gauss Newton Method** for nonlinear least squares regression
- Solved a **constrained optimization problem** for economic dispatch of the system using the **Kuhn-Tucker conditions**

Adaptive Backstepping Controller Design

Aug-Oct 2020

- Designed **adaptive attitude tracking controller** for unknown robot inertia parameters using **integrator backstepping**

Model Predictive Control of Tank Reactor

Feb-Apr 2020

- Designed a **model predictive controller** for a nonlinear system using innovation bias for model-plant mismatch
- Designed a nominal state estimator for prediction via pole placement method using a linear perturbation model

Optimal Control of a Plug-in Hybrid Vehicle

May-Oct 2019

Summer Project: [Prof. Ravi N. Banavar](#), Dept of Systems and Control

IIT Bombay

- Formulated **optimal control problem** (OCP) for minimizing fuel consumption for given position, speed profile
- Built **modular closed loop simulator** on Simulink for various driving cycles and road grades
- Solved a representative OCP with input constraints via **multiple shooting** and **Pontryagin's Maximum Principle**

Heliostat Tracking and Control

May-June 2019

- Implemented a **sun tracking algorithm** using solar geometry, newton raphson method on an Arduino microcontroller

6 Degree of Freedom Stewart Platform

May-Jul 2018

- Constructed a **servo actuated** Stewart Platform using **parallel manipulators** to achieve six degrees of freedom
- Employed **inverse kinematics** for controlling servo motors using **Arduino** microcontroller to achieve desired pose

KEY COURSES UNDERTAKEN

Systems and Control	Advanced Process Control, State Estimation, Adaptive Control, Optimal Control
Mathematics	AI in Chemical Engg, Optimization, Data Analysis, Numerical Analysis, System Modeling
Electrical Engineering	Power Electronics, Electrical Machines, Signals and Feedback Systems
Mechanical Engineering	Mechanics of Materials, Kinematics and Dynamics of Machines

MENTORSHIP AND VOLUNTEERING

Volunteer | [Hands On Tokyo](#)

Feb 2023-Present

- Volunteered over 50 weeks with Hands-on Tokyo to support special needs athletes prepare for Special Olympics

Academic Mentor | [Department Mentorship Program](#)

Jul 2020 - Apr 2021

- Assisted 4 sophomores in their academic pursuits, wrote a department blog [article](#) on internship anxiety

Teaching Assistant | [Numerical Methods](#), [Advanced Process Control](#)

July 2021 - May 2022

- Conducted programming tutorials and evaluated coding assignments, course projects and written quizzes

Volunteer | [Asha for Education](#)

May-July 2019

- Contributed 40+ hours of volunteer work tutoring marginalized high school students in math and science

TECHNICAL SKILLS

Programming

C++, Python, ROS, MATLAB

Softwares

CarMaker, AutoCAD, Simulink, SolidWorks, Arduino IDE

HOBBIES AND EXTRA-CURRICULARS

- Hobbies: I like baking, crocheting, swimming, and reading fantasy novels in my free time
- I swam a distance of 13.5 kms in 12 hours at **Swimmathon, IIT Bombay 2018** during my freshman year