

Shaswat Garg

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Department of Mechanical Engineering (ME)
Delhi Technological University (DTU), New Delhi, India

EDUCATION

Delhi Technological University, India

Aug. 2019 – Present

- BTech in Mechanical Engineering; GPA: 9.45/10; Ranking: 2/230

D.A.V. Public School, India

Aug. 2017 – Jul. 2019

- Higher Secondary Degree in PCM; Cumulative Average: 92.2%

SKILLS

Programming: Python, MATLAB (proficient), C++ (intermediate)

Frameworks: Pytorch, Tensorflow, Keras

Analysis Tools: ROS, Gazebo, Rviz, Moveit, Solidworks, ANSYS

Hardware: Arduino UNO

Engineering Skills: Deep Learning, Reinforcement Learning, Motion Planning, Mechanical Design, Simulation

PROJECT EXPERIENCE

Optimization of Double Wishbone Suspension Geometry for Off-road Vehicles

Sep. 2022 – Present

Undergraduate Major Project at DTU

Supervisor: [Prof. Vikas Rastogi](#) and [Prof. Atul Kumar Agarwal](#)

- Working on reducing the design phase time of a suspension system for off-road vehicles using Genetic Algorithm by optimizing the caster, kingpin, toe and camber angles.
- Focused on improving the dataset and integrating other deep learning methodologies to improve the accuracy of the predictions.
- Used Bayesian learning technique, particularly Gaussian Regression with a Mattern 3/2 Kernel to predict the design properties of a given double wishbone system (accepted in ICMAE 2022 as first author [1]).

Kinematics and Control of Continuum Robots using Deep Learning

May 2022 – Aug. 2022

MITACS GRI at [Robotics, Mechatronics and Automation Laboratory \(RMAL\)](#), TMU

Supervisor: [Prof. Farrokh Janabi-Sharifi](#) and [Prof. Masoud Goharimanesh](#)

- Conducted Literature Survey on Machine Learning and Deep Learning based control of continuum robots and investigated the drawbacks of existing methods for autonomous planning of soft robots.
- Implemented different reinforcement learning methods like DDPG, TD3, SoftQ, SAC, NAF and constraint based Safety Layer from scratch using PyTorch library.
- Proposed a constraint based **Safe Reinforcement Learning** methodology using Soft Actor Critic and Covariance Matrix Adaptation as base to promote efficient exploration of state and action space along with ensuring the safety of the robot.
- Developed an environment using the **Open AI's Gym** package using a static model based on the classical **Cosserat-rod** and **Cosserat-string** models.

Dynamic Analysis of Hunting Phenomena in Railways

Aug. 2021 – Feb. 2022

Research Intern at [Mechatronics Laboratory](#), IIT Delhi

Supervisor: [Prof. S.K. Saha](#) and [Prof. S.P. Singh](#)

- Conducted a survey on dynamic modelling of railway models of different Degree of Freedoms (DOFs) and investigated the the hunting stability and wheel rail contact problem for knife edge rails and symmetrical conical wheels using different numerical models like Jacobian method on MATLAB.
- Developed an user friendly simulation tool – Railhunt to study the hunting stability of a railway vehicle using App-designer toolbox on MATLAB (accepted in *Railways* 2022 as first author [2]).
- Studied the effects of dissimilar properties among rail components due to uneven wear and loading on hunting critical speed for a 17 DOF rail model developed using the Decoupled natural orthogonal complement (DeNOC) method. (in Review in *Journal of rail and rapid transit (JRRT)* as first student author)

Inverse Kinematics of Continuum Robot using Deep Learning

Jan. 2022 – Mar. 2022

Undergraduate Research Intern at Robotics Lab, DTU

Supervisor: [Prof. Vikas Rastogi](#)

- Investigated different kinematic models of continuum robots like Piecewise Constant Curvature Model, Cosserat Continuum Model etc. and reviewed the complexity of performing inverse kinematics using different methods.
- Implemented different machine learning and neural network models like Radial Basis Functions, Extreme Learning Machine, Decision Tree etc. from scratch using Tensorflow.
- Developed an Invertible Neural Network for the inverse kinematic modelling of single section tendon driven continuum robot (accepted in *Comp Auto 2022* as first author [\[3\]](#)).

Design and Analysis of Trellis Frame of an Electric Motorcycle

Dec. 2020 – Jul. 2021

Chassis Engineering Intern at [HyperX Energy](#) (IIT Delhi Funded Startup)

Mentor: [Raman Sharma](#) (Co-Founder and CEO)

- Tasked to design and analyze a light weight Trellis Frame for Prototype II against different conditions like maximum acceleration, maximum braking etc. using Solidworks and ANSYS.
- Developed a Simulink Model on MATLAB to validate the simulation results and mathematical calculations on different terrains.

Motion Planning of a point robot using various path planning algorithms

Apr. 2021 – May. 2021

Undergraduate Project at DTU

- Implemented A*, Dijkstra, BFS, PRM, RRT path planning algorithms for a point robot in a 2D obstacle environment using Python and OpenCV.
- Applied concepts of Object-oriented programming and Priority Queue to write clean and well documented codes.[\[code\]](#)

SELECTED PUBLICATIONS

- [1] S. Garg, S. Dudeja, S. Gupta and V. Rastogi, "Optimization of a Double Wishbone Suspension Geometry for Off-road Vehicles using Genetic Algorithm and Machine Learning," *2022 13th International Conference on Mechanical and Aerospace Engineering (ICMAE)*, 2022, pp. 472-477. [\[paper\]](#) [\[code\]](#)
- [2] S. Garg, S. Vishnu, S.P. Singh and S.K. Saha, "Railhunt – An interactive tool for hunting stability analysis of a railway carbody," *The Fifth International Conference on Railway Technology: Research, Development and Maintenance*, 2022
- [3] S. Garg, S. Dudeja and V. Rastogi, "Inverse Kinematics of Tendon Driven Continuum Robots using Invertible Neural Network," *The Second International Conference on Computers and Automation*, 2022
- [4] S. Garg, S. Dudeja, S. Gupta and N. Gupta, "Artificial Neural Networks Based Real-time Modelling While Milling Aluminium 6061 Alloy," *Soft Computing in Materials Development and its Sustainability in the Manufacturing Sector*, 2022, pp. 37-48, CRC Press. [\[paper\]](#)
- [5] S. Vishnu, S. Garg, S.P. Singh and S.K. Saha, "Differential parametrization of rail vehicle properties and their impact on the hunting stability," *Review in SAGE's journal of rail and rapid transit (JRRT)*

LEADERSHIP

Deltech BAJA

Sep. 2019 – Present

Vice Captain

DTU

- Leading Asia's oldest Baja Team of 35+ students with a goal to manufacture an All Terrain Vehicle.
- Led a sub-team of 7+ members responsible for designing and analyzing Roll Cage.
- Initiated several new projects like the design and manufacturing of a new 4WD concept for 2023, integrating new simulation and design methods to optimize the weight and performance of the vehicle.

SELECTED HONOURS

- **Second Runner-up** in CAE event at BAJA SAE India 2022 (highest level in Asia)
- **Overall Runner-up** in Static event at FMAE BAJA India 2022
- Awarded **Academic Excellence Award** for being in 0.1% (1.3 Million+ candidates) of CBSE Merit List in Class 12th by school.
- Secured an **AIR 2936** JEE Mains, among 0.2% (1.1 Million+) participants across India.