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EDUCATION:

Secondary:
DELHI PUBLIC SCHOOL, R.K. PURAM, New Delhi, India
Board- Central Board of Secondary Education (CBSE)
CGPA: 10

Senior Secondary:
DELHI PUBLIC SCHOOL, R.K. PURAM, New Delhi, India
Board- Central Board of Secondary Education (CBSE)
Subjects: Physics, Chemistry, Maths, Computer Science, English
Marks: 96%

Dual Degree (B.Tech + M.Tech):
INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR, India
Major: Mechanical Engineering, specialization in Mechanical Systems Design
CGPA: 8.18

RESEARCH EXPERIENCE:

Bachelors and Masters Project: Design & Analysis of Railway Suspension with Watt's Linkage
Indian Institute of Technology Kharagpur, under Prof. Anirvan DasGupta, Department of Mechanical Engineering, *July 2019 - present*

- Initially developed a two-dimensional (cross-sectional) model of railway carriage to determine suitable link lengths for Watt's linkage to be added to the underbelly of the carriage.
- Using the link lengths obtained from the 2D model, performed three-dimensional 15 DoF multibody dynamics simulation of the railway carriage using Python (using NumPy and SymPy libraries) and Matlab to study the effect of suspensions on hunting oscillations. The model used was based on an existing model proposed by Zolotas et al[1].
- Drew comparisons between the effectiveness of the railway suspensions with and without the Watt's linkage using Sperling Ride Index.
- It was found that the addition of the Watts linkage does improve upon the performance of the railway suspension system, however, there was a tradeoff- horizontal vibrations are reduced while vertical vibrations are increased. This was deemed acceptable as the horizontal vibrations are an order of magnitude higher than vertical vibrations.
- Currently working on a three dimensional model in Adams Multibody Dynamics Simulation Software for force analysis on the Watts linkage during acceleration and breaking. This will be used to design the links used in the Watt's linkage.

Summer Research Internship: Finite Element Analysis of Gerbil Cochlea
Mass. Eye and Ear (teaching hospital of Harvard Medical School) under Dr. Sunil Puria, Dept. of Otolaryngology, *May 2019 - July 2019*.

- Created 2D and 2.5D finite element models of the Organ of Corti and surrounding fluid spaces of the gerbil cochlea using COMSOL Multiphysics. A three-node triangular plane strain element was used for the 2D model, while a four-node tetrahedral solid element was used for the discretization of the 2.5D model.
- A three-dimensional slice of the cochlea was used for the 2.5D model, to accommodate stereocilia which are present in the form of discrete bundles. Periodic boundary condition was taken in the out-of-plane direction.
- Since the displacements and strains were small it was sufficient to use linear strain displacement relations. The material was considered to be linear elastic.

[1] Zolotas, A. C., & Goodall, R. M. (2007). Modelling and Control of Railway Vehicle Suspensions. In: Turner, M.C. and Bates, D.G. (eds.) *Mathematical Methods for Robust and Nonlinear Control Lecture Notes in Control and Information Sciences,* 373-411.

- Fluid-structure interaction module was used as the effect of the fluid spaces on the tectorial membrane was of primary interest. Fluid was considered to be incompressible. Flow was considered to be in steady-state.
- Investigated hypotheses stating that there is a pressure difference between the inner spiral sulcus and the scala media which is instrumental in maintaining the gap height of the sub tectorial region. Performed parametric studies to gauge the response of the system over a range of pressures.
- This work was presented by Dr. Puria at The International Otopathology Society Meeting (2019) organized at Harvard Medical School.

Summer research internship: Vibration Control of Unimorph Piezoelectric Laminated Cantilever Beam
Vibration Control and Energy Harvesting Lab, Indian Institute of Technology Chennai, under Prof. Sheikh Faruque Ali, Department of Applied Mechanics, *May 2018 - July 2018*
- Developed finite element model of smart laminated cantilever beam in MATLAB for carrying out simulations for static and dynamic analysis of beam.
- Euler-Bernoulli beam theory was used to form the differential equations, and the Ritz method was used for finite element formulation. Three degrees of freedom per node were considered namely axial displacement, transverse displacement, and slope. Axial displacement was taken to account for the asymmetric sections of the beam and to model the axial actuation force.
- Piezoelectric strip was taken to be the actuator and voltage as the input to the system. The actuation force and moment were calculated using the converse piezoelectric effect.
- These equations were converted into state-space form and Proportional-Integral-Derivative (PID), Linear-Quadratic-Regulator (LQR), and integral backstepping controllers for vibration of beam were developed and the response due to each was compared. The parameters for PID and LQR were both tuned manually.
- PID and LQR are both well known linear control strategies. Integral backstepping is used for nonlinear dynamical systems, and was considered so as to potentially identify a superior control strategy. However, since the system is ultimately linear, it did not offer any significant benefits.

Independent Research Group: Aerial Robotics Kharagpur
guided by Prof. Somesh Kumar and Prof. Jayanta Mukhopadhyay, *February 2017 - January 2019*
- Worked in the controls division of the student lead research team. Also helped with building and calibration of UAVs.
- Implemented a simplified dynamic model of a quadrotor using MATLAB Simulink.
- Designed a Proportional-Integral-Derivative (PID) controller for controlling altitude and attitude of a quadrotor along with trajectory control and obstacle avoidance, considering high-level commands (roll pitch and yaw) as the control inputs. Simulations were carried out using Gazebo in a ROS and Linux environment using MAVROS protocol.
- Implemented these control strategies on UAVs using flight control boards Pixhawk and APM with Arducopter and PX4 firmwares. MAVROS protocol was used for communication with either remote PC or onboard Raspberry Pi.
- Invited to International Aerial Robotics College seminar in Beijing, China in August 2018.

SKILLS:

Programming/Tools	C • C++ • MATLAB • Python • Bash • Linux • LaTeX • Git • Dart
Software and Frameworks:	TensorFlow • Keras • Numpy/Sympy • Solidworks • COMSOL • Adams Multibody • Gazebo • ROS (Robot Operating System) • MAVROS • Arduino • Android Studio • Flutter • Adobe Photoshop • Adobe Illustrator
Institute Coursework	**Mechanical Engineering:** Dynamics • Fluid Mechanics • Kinematics of Machines • Mechanics of Solids • Engineering Drawing • Machine Design • Materials Engineering • Machine Tools and Machining • Finite Element Methods in Engineering • Systems and Control • Applied Elasticity • Mechanics of Human Body • Mechanisms and Robot Kinematics • Lubrication and Rotor Dynamics • Design Optimization • Vibration Analysis • Vibration Control and Isolation **Mathematics and Programming:** Partial Differential Equations • Transform Calculus • Probability and Statistics • Programming and Data Structures • Design and Analysis of Algorithms • Genetic Algorithms • Image Processing
Non-Institute Coursework	Deep Learning Specialization (MOOC offered at Coursera by DeepLearning.AI): Neural Networks and Deep Learning • Improving Deep Neural Networks: Hyperparameter Tuning, Regularization and Optimization • Structuring Machine Learning Projects • Convolutional Neural Networks • Sequence Models

SCHOLASTIC ACHIEVEMENTS:

Awarded assistantship to dual degree students with CGPA above 8 by IIT Kharagpur, 2020

Accepted into University of Alberta Research Experience (UARE) program for summer 2020. The program was cancelled due to COVID-19 travel restrictions.

Selected for Kishore Vaigyanik Protsahan Yojana (KVPY) Scholarship, All India Rank: 767, 2016

Received Gold Medal for excellence in academics for seven years in DPS R.K. Puram, 2016

Received Junior Science Talent Search Examination Scholarship [JSTSE] organised by the Delhi Government, 2013, Rank: 8

Received National Talent Search Examination Scholarship [NTSE] organised by Government of India, 2012, State Rank: 20

POSITIONS OF RESPONSIBILITY:

Coordinator, Technology Robotix Society (February 2017- present)
- Managed a three-tier team of 42 to plan events in Robotix 2019 attracting 800+ participants from over 60 colleges during the Techno-management festival of IIT Kharagpur.
- Coordinated with the administration & to handle a budget of INR 6 lakhs.
- Organized introductory classes on robotics for first-year students. Conducted Winter Workshop on Autonomous Robotics and Image Processing in association with IEEE for first and second-year students

Governor, Western Technology Music Society (July 2020 - present)
- Manage of team of over 30 student musicians to plan and conduct yearly concerts at the institute level and also represent the institute at the annual inter IIT cultural meet.

Captain- Music Team, Rajendra Prasad Hall of Residence (July 2020 - present)
- Led a multi-tier team of students to represent Rajendra Prasad Hall of Residence at the Inter Hall General Championships Music Cup.

Unit Lead, National Service Scheme (December 2016)
- Led a team of 40 students to teach school children, conducted surveys and perform routine maintenance work on issues that affect the residents of village Khelar, West Bengal.
- Conducted awareness campaigns on public concerns such as primary education, sanitation etc through plays, marches etc.