

Vinit Doke

Curriculum vitae

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I am interested in the fields of Nanoelectronics, Semiconductor Physics, and Semiconductor Manufacturing. I am intrigued by computational methods applied in these domains and also interested in pursuing experimental research in the same.

Education

2019 - **Indian Institute of Technology Bombay (IIT Bombay)** .
Present (Inter-disciplinary Dual-Degree Program)
B.Tech in Engineering Physics (Expected Completion : **2023**)
M.Tech in Electrical Engineering (Expected Completion : **2024**)
CPI : 8.44/10

Research Experience

May-Jul **MITACS Globalink Research Internship : Automating Pump-Probe Spectroscopy.**
2022 *Supervisor: Prof. Ziliang Ye, Dept. of Physics and Astronomy, University of British Columbia, Vancouver*
[URL](#)

- Developed python control scripts and GUI for automated operation of a Pump-Probe Spectroscopy setup involving precision Translation Stages and Data Acquisition devices like Lock-In Amplifiers, Photo-detectors and Spectrometers.
- Implemented **Convolutional LSTM** for predicting Fracture Propagation Patterns in 2D Materials
- Wrote a dynamic-control script for wavelength-tuning of laser output based on live data acquired from a spectrometer and corresponding actuation of a linear-stage mounted Wavelength Filter.

May-Aug **Graphene-based Energy Harvesting.**
2021 *Supervisor: Prof. Bhaskaran Muralidharan, Dept. of Electrical Engineering, IIT Bombay*
[URL](#)

- Involved in designing a Graphene-based Energy Harvester on the basis of modelling and simulating (in COMSOL) an Electret-based Variational Capacitor for Energy Extraction from Graphene's Ambient Vibrations.
- Conducted an extensive literature survey of Mechanical Properties of Graphene Ripples, Energy Harvester Circuits and Electromagnetic properties of Electret Materials for application to a Graphene MEMS device
- Studied **Stochastic Differential Equations** to model and approximate equilibrium behavior of such a device and simulated the same (numerically) in Python

Key Projects

Feb-April **Near Field Radiative Heat Transfer.**
2021 *Prof. Anshuman Kumar, Course Project: Waves, Oscillations and Optics*
[URL](#)

- Using python, simulated the **Near Field Radiative Heat Transfer** between two $\alpha - MO_3$ crystals numerically, using **Fluctuation-Dissipation Theorem** and **4×4 Transfer Matrix method**.
- Performed parametric analysis of the effect of geometric orientation of the crystals on Net Heat Flux Transfer and created an **executable paper** with Heat plots and tunable parameters.
- Identified the existence of Hyperbolic Surface Phonon Polaritons (HSPHPs) using the deviations in the Heat Plots from Hyperbolic Phonon Polaritons (HPPs).

Jul-Dec **Underlying Event Characteristics of p-p collisions.**
2020 *Prof. Sadhana Dash, Course Project: Data Analysis and Interpretation*
[URL](#)

- Analyzed data from **Underlying Events** in proton-proton collisions at 13TeV obtained using Pythia 8 Monte Carlo Generator.
- Generated histograms of Rapidity, Pseudo-rapidity, Azimuthal and Transverse Momentum using ROOT Macros and analysed changing values of standardized variance and skewness for different multiplicity classes

Dec 2020 **Computational Physics, Reading Project**, Maths and Physics Club.

- [URL](#)
- Implemented Numerical Methods for evaluation of various Mathematical Structures useful for simulation and calculation of Classical and Modern Physics Problems in Python
 - Coded from scratch Differential Equation Solvers, Integrators, Monte-Carlo Simulations and 2D/3D Visualisation Techniques and applied them to problems like Interference and Diffraction Patterns, Non-Linear Systems, Random Processes and Radioactive Decay

Dec 2020 **Image Encryption using pseudorandom sequences.**

- [URL](#) *Prof. Amitabha Nandi, Course Project, Nonlinear Dynamics*
- Implemented an Image Encryption Algorithm utilising Pseudo-random Sequences generated by Logistic Map and an 8-bit Linear Feedback Shift Register in Python
 - Performed Statistical and Entropy Analysis to evaluate efficiency of the Encryption Algorithm

Mar - Jun 2020 **Hand Gesture Recognition, Technical Project**, Institute Technical Council.

- [URL](#)
- Prototyped and Trained a custom CNN model in TensorFlow to classify static Hand Gestures to map to Navigation Inputs for an ATM Interface for contactless operation and mitigation of spread of contagious diseases
 - Made extensive use of OpenCV to extract human hands and gestures from an image using Background Subtractors, Adaptive Threshold Masks and Edge Detectors alongwith Object Detection through R-CNN

Dec 2020 **Arithmetic Logic Unit (ALU) Design in VHDL.**

- Prof. Virendra Singh, Course Project, Digital Systems*
- Implemented 16-bit Arithmetic Logic Unit in Quartus (VHDL) based on Kogge-Stone Prefix Adder Architecture along with Subtract, XOR and NAND Operations alongwith 4×1 Multiplexer control using structural description
 - Programmatically generated testcases using Random Number Generation for Testbench Simulation of the architecture

Positions of Responsibility

Aug 2020 **Vice Head, Software Subsystem | Team Rakshak IIT Bombay.**

- Present
- Responsible for conducting literature reviews of new developments in Computer Vision and providing aid in various administrative activities associated with recruitment, training and analysis of weekly workings of the subsystem
 - Worked in a Team of 4 in the Object Detection sub-group of the Unmanned Aerial Vehicle Team of IIT Bombay targeting the AUVSI-SUAS International Competition for Unmanned Aerial Systems
 - Implemented and Optimized Object Detection Models like YOLO v5 to identify and locate objects of interest in live Drone Footage for further Classification, Geo-Tagging and Mapping

May-Jun 2021 **Teaching Assistant, BB101 - Biology.**

- Dept. of Biosciences and Bioengineering, IIT Bombay*
- Part of a team of 35 undergraduate and 15 postgraduate teaching assistants selected on the basis of exceptional academic prowess exhibited in the course to assist in teaching of 1000+ students
 - Conducted weekly interactive tutorial sessions for 80+ students and discussed doubts related to concepts learnt in lectures which aided them in understanding topics in Physical Biology and Biomedical Engineering
 - Modelled a Rotating 3D Helix with Force and Velocity vectors to visualise Bacterial Propagation using Flagellum

Scholastic Achievements

- 2022 Selected for the Mitacs Globalink Research Internship Award for a 12-week fully funded research internship at University of British Columbia, Vancouver, Canada.
- 2020 Ranked in Top 10 in MATLAB Cody challenge organised by MathWorks.
- 2019 Awarded **AP Grade (Academic Proficiency)** for BB101 Biology Course (Secured by top 8 out of 600 students).
- 2019 Secured 99.27 percentile in JEE Mains among 1.2 million candidates.
- 2016 Secured State Ranks 2 and 7 in Maharashtra Talent Search Examination for Class 9th and 8th.

- 2016 Bagged Silver Medal in Dr. Homi Bhabha Young Scientist Examination consisting of three rounds of written, practical and project based evaluation respectively.

Technical Skills

Programming	Python, C++, FORTRAN, MATLAB & Simulink, VHDL, Wolfram Language
Data Analysis	CERN ROOT, MS Excel, OriginLab, SQL
ML/DL	TensorFlow, PyTorch
Softwares	COMSOL (Electrostatics Package), LTSpice, Blender 3D, SolidWorks, AutoCAD, Git

Key courses

Electrical Engineering	Electronic Devices and Circuits, Digital Systems, Digital Electronics Lab, Microprocessors Lab, Electronics Labs (Basic Circuits and OpAmp Circuits).
Physics	Semiconductor Physics, Photonics, Quantum Mechanics I & II, Classical Mechanics, Waves & Oscillations & Optics, Nonlinear Dynamics.
Mathematics	Finite Element Method, Group Theory Methods in Physics, Complex Analysis, Multivariable Calculus, Linear Algebra, Differential Equations, Introduction to Numerical Analysis, Data Analysis & Interpretation.
Computer Science	Parallel Computing and Scientific Data Visualisation, Foundations of Intelligent and Learning Agents (Reinforcement Learning), Introduction to Machine Learning, Neural Networks and Deep Learning (Coursera), Computer Programming and Utilization.

Extracurriculars

- 2019-2020 **Sports.**
- Underwent year-long training for Professional Weightlifting under National Sports Organisation (NSO)
- 2019-2021 **Video Editing & 3D Modelling.**
- Shot and edited a spoof video which stood 1st in "Freshiezza" Freshmen Video Editing competition
 - Mentored a group of freshmen to learn Blender 3D and realize their first 3D Art Projects
 - Used Blender 3D to create a slow motion shot of falling cards as a promo video for an event held by the Student Alumni Relations Cell of the institute
- 2018 - 2021 **Others.**
- Mentored a team of 4 freshmen to develop a CNN Classification Model based Brain-Computer Interface
 - Scored 98/100 marks in French in Class 12th with basic proficiency
 - Completed 10 Levels of Abacus and Mental Math Techniques