

SHRAVAN GODSE

Indian Institute of Technology, Bombay

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EDUCATION

Indian Institute of Technology, Bombay

Bachelor of Technology (with honors) in Mechanical Engineering

July '18 - Present

Mumbai, India

- CPI (after 6 semesters) : **8.97/10**
- Ranked **17th** in a batch of **120+**
- Pursuing a minor in Management from Shailesh J. Mehta School of Management

Arihant Jr. College

Higher Secondary Education

June '16 - June '18

Pune, India

- Secured **90.31%** in Class XII exams (stood **second** in the institute)
- Awarded INSPIRE scholarship by Department of Science and Technology, GoI for performance in **top 1%**

PUBLICATION

Shravan Godse, Yagyank Srivastava, Ankit Jain *Anharmonic Lattice Dynamics in Type-I Clathrates*
(under review, 2021)

RESEARCH EXPERIENCE

Materials Research Lab

July '20 - Present

Guide: Prof. Ankit Jain | Department of Mechanical Engineering

IIT Bombay

Working as an Undergraduate Research Assistant exploring Machine Learning enabled materials discovery, Density Functional Theory (DFT) and DFT driven thermal conductivity prediction

Multichannel Thermal Transport in type-I Clathrates (Bachelors Thesis I)

- Computed temperature dependent lattice thermal conductivity of type-I clathrates $X_8Ga_{16}Ge_{30}$ (X: Sr/Ba), using inhouse ab-initio based anharmonic lattice dynamics code on Spacetime-HPC at IIT Bombay
- Accounted for 3ph scattering, coherent transport channel and boundary+isotope scattering
- Obtained several lattice dynamical properties viz. Dispersions, DoS, Atomic Displacement Parameters, etc.
- Deployed phonon-renormalization and T-dependent PES sampling to account for strong anharmonicity
- Obtained DFT potential energy surface and force-field around Ba/Sr atoms in tetrakaidecahedral cages
- Visualized clathrate crystal structure, bonds, polyhedral cages, phonon mode-eigenvectors in VESTA

Lattice Dynamical Properties using Machine Learning (Bachelors Thesis II, ongoing)

- Obtained material fingerprints using **Voronoi Tessellation** and **Local Property difference** technique
- Employing techniques like **neural networks**, regression, **random forests**, KNN, to predict lattice dynamical properties like heat capacity, sound velocity and mean square displacements

Vibrational Spectra of FAPbBr₃

May '21 - August '21

Guide: Prof. David Egger | Department of Physics

TU Munich

Research Internship at **Theory of Functional Energy Materials** Lab at TU Munich, Germany (WFH)

- Investigated potential energy surface of FA^+ in $PbBr_3$ environment and optimized hybrid perovskite structure
- Reviewed and performed Van-der Waals corrections using Tkatchenko-Scheffler method in VASP
- Obtained phonon dispersion curves of Si, GaAs and FAPbBr₃ using PhonoPy with finite difference method
- Simulated **infrared and Raman spectra** of FAPbBr₃ using VASP and PhonoPy-Spectroscopy modules

Materials Simulation

April '20 - July '20

Guide: Prof. Dipanshu Bansal | Department of Mechanical Engineering

IIT Bombay

Simulated Bandstructure, Density of states and Phonon Dispersions of materials using DFT software

- Reviewed concepts in solid state physics and completed an online course on Density Functional Theory
- Performed SCF calculations for convergences with respect to energy cutoffs and k point sampling
- Obtained bandstructure and phonon dispersion curves for **Al** and **Si** using **Quantum Espresso**
- Obtained the density of states (total and orbital projected) using dos.x and projwfc.x modules in Espresso

INDUSTRY EXPERIENCE

Advance Engineering Intern | Varroc Engineering Ltd.

December '19

Guide: Mr. Lohit Dhamija - Manager, Advance Engineering

Pune

Varroc is a global technology powerhouse in manufacturing and supplying automotive components

- Researched various charging strategies for Lithium-ion batteries for Electric Vehicle applications
- Studied and presented Constant Current-Constant Voltage (CC-CV), Multistage, Pulsed and Fuzzy Control based charging of lithium-ion batteries based on literature reviews
- Modelled CC-CV and Multistage charging in Simulink to compare for an optimal charging profile

KEY COURSE PROJECTS

Archimedes Screw for Manhole Cleaning | **Website**

Autumn '21

Course : Machine Design

Instructor: Prof. Shantanu Tripathi, Department of Mechanical Engineering

IIT Bombay

- Working in a team of 7, designing engineering solutions to alleviate the issue of manual scavenging in India
- Modeled an archimedes screw in **Fusion 360** and estimated efficiency, torque and power requirements

Non-uniform meshed Schrodinger-Poisson | **Report**

Autumn '20

Course : Physics of Nanoelectronic Devices

Instructor: Prof. Dipankar Saha, Department of Electrical Engineering

IIT Bombay

- Obtained a **99.64% accuracy** with **1/10th computational resources** upon solving Schrodinger equation using non-uniform mesh for a finite quantum well using **Python**
- Implemented the self-consistent Schrodinger-Poisson equation to obtain carrier densities in AlGaAs and GaAs

BiDet-binarized object detector | **Report**

Autumn '20

Course : Deep Learning, Theory and Practice

Instructor: Prof. P. Balamurugan, Department of IEOR

IIT Bombay

- Worked in a team of 4 and used a binarized neural network Bidet by **Wang et;al** for object detection
- Experimented on PASCAL-VOC and COCO datasets for training and testing the object detector

Benzene Molecule Simulation | **Report**

Autumn '20

Course : Introduction to Ab-initio methods

Instructor: Prof. Sumit Saxena, Department of Materials Science

IIT Bombay

- Utilised **Quantum Espresso** to carry out Density Functional Theory calculations on **Benzene molecule**
- Performed self consistent calculations using pw.x module and visualized the **molecular orbitals** of Benzene

TECHNICAL ACTIVITIES

Nonlinear Dynamics and Chaos | **Report**

Summer '20

Summer of Science, Maths and Physics Club

IIT Bombay

- Applied concepts of Nonlinear Dynamics and Chaos to Economic Supply-Demand models
- Performed extensive study of Nonlinear Dynamics through books by Strogatz, Shone and online resources
- Simulated the Cobweb Model with Adaptive Expectations for nonlinear supply by Cars Homes, 1994 (Journal of Economic Behavior and Organization) using MATLAB and demonstrated chaotic behavior

Junior Controls Engineer | **Exofly IIT Bombay**

Summer '20

Institute Technical Council

IIT Bombay

- Worked in a **33 member** tech-team in the institute with a vision of developing a **Personal Air Taxi**
- Completed MATLAB Onramp and modeled thermostat and Falcon's flight as a part of Simulink Onramp
- Modeled a **Deca-copter** (UAV with ten rotors) in **Simulink** using custom made blocks

TECHNICAL SKILLS

Languages : Python, MATLAB, C++, HTML*, CSS*

Softwares and Packages : Simulink, NumPy, Matplotlib, Pandas, Keras, Scikit-Learn

Materials Simulation/Querying : Quantum Espresso, VASP, Phonopy ASE, Matminer, Pymatgen

Others : Autocad, L^AT_EX, Fusion 360, Inkscape, MS Office,

*basic proficiency

SCHOLASTIC ACHIEVEMENTS

- Awarded a merit-based **branch change** based on exemplary academic performance in the first year [’19]
- Secured **All India Rank 1242** among **2 lakh** candidates in **JEE Advanced** for admission to IITs [’18]
- Secured **All India Rank 3433** among **1.1 million** in **JEE Main** entrance exam [’18]
- Awarded **Undergraduate Research Award** for contributions to research in lattice dynamics [’21]
- Amongst **top 1 %** students in **National Standard Examination in Physics** and **National Standard Examination in Astronomy** conducted by Indian Association of Physics Teachers [’18]
- Recipient of the prestigious **Kishore Vaigyanik Protsahan Yojana (KVPY) scholarship**, a national fellowship awarded by Dept. of Science & Technology, Government of India [’18]

KEY COURSES

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| Mechanical Engineering Curriculum* | Fluid Mechanics, Solid Mechanics, Thermodynamics, Heat Transfer Mechanical Measurements, Manufacturing Processes |
| Machine Learning, Math | Deep Learning-Theory and Practice, Statistical Machine Learning and Data Mining, Linear Algebra, Multivariable Calculus |
| Physics, Materials Science | Quantum Physics, Physics of Nanoelectronic Devices, Introduction to Ab-initio Methods, Lattice Dynamics and Thermal Transport |

*associated Lab Course

MENTORSHIP ROLES

Institute Student Mentor *June ’21 - Present*
Institute Student Mentorship Program *IIT Bombay*

- Part of a 133-member team selected out of 300+ applicants on the basis of overall performance in the institute via a rigorous procedure of SoPs, interviews and peer reviews
- Responsible for mentoring a group of incoming freshmen aiding them adjust to life at IIT Bombay

Department Academic Mentor *July ’20 - May ’21*
Department Academic Mentorship Program *IIT Bombay*

- Mentored 6 sophomores in the department to provide academic guidance and general counsel
- Functioned as the First Point of Contact, aiding communication between students and faculty

Summer of Science Mentor *May ’20 - July ’20*
Math and Physics Club *IIT Bombay*

- Mentored students over the summer of 2020 in a detailed study on Controls Theory and its applications
- Provided them with textbooks and online resources on Controls Theory pertaining to topics of their interest

EXTRACURRICULAR ACTIVITIES

- Volunteering at National Service Scheme’s, Open Learning Initiative, creating free educational content in local languages for underprivileged school students in the state of Maharashtra
- Volunteered at Krittika, the astronomy club of IIT Bombay, conducting star gazing activities and lectures
- Finished year long training in Swimming under National Sports Organization (NSO)
- Completed 3 levels of Indian Classical Music (Vocals) and 1 level of Harmonium (Indian Classical)
- Completed Fit in Deutsch 1 (A1 level proficiency in German) conducted by Goethe Institut

REFERENCES

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| Prof. Ankit Jain Materials Research Lab Department of Mechanical Engg. IIT Bombay a_jain@iitb.ac.in | Prof. David Egger TheoFEM Lab Department of Physics TU Munich, Germany david.egger@tum.de | Prof. Dipanshu Bansal Vibrational Spectroscopy Lab Department of Mechanical Engg. IIT Bombay dipanshu@iitb.ac.in |
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