# SHRAVAN GODSE

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## EDUCATION

**Indian Institute of Technology, Bombay**  *July '18 - Present*
Bachelor of Technology (with honors) in Mechanical Engineering  *Mumbai, India*
- CPI (after 6 semesters) : **8.97/10**
- Pursuing a minor in Management from Shailesh J. Mehta School of Management

**Arihant Jr. College**  *June '16 - June '18*
Higher Secondary Education  *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 and Thermal Transport 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
Awarded **Undergraduate Research Award-1** by IIT Bombay for contributions to research in lattice dynamics
**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-inito 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 $FAPbBr_3$**  *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 $FAPbBr_3$ using PhonoPy with finite difference method
- Simulated **infrared and Raman spectra** of $FAPbBr_3$ 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 **$1/10^{th}$ computational resources** upon solving Schrodinger equation using non-uniform mesh for finite quantum well in **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 Thoery 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

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|---|---|
| **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, LaTeX, 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 the **Scholarship for Higher Education (SHE)** under INSPIRE scheme by **DST**, Government of India for outstanding performance scoring in top 1% in class XII examination [*'18*]
- 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-inito Methods, Lattice Dynamics and Thermal Transport |

# Mentorship Roles

### Institute Student Mentor
*Institute Student Mentorship Program*

*June '21 - Present*
*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
*Department Academic Mentorship Program*

*July '20 - May '21*
*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
*Math and Physics Club*

*May '20 - July '20*
*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

- Volunteered at Krittika, the astronomy club of IIT Bombay, conducting star gazing activities and lectures
- An active member of Materials Science student interest group
- 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 | Prof. David Egger | Prof. Dipanshu Bansal |
| Materials Research Lab | TheoFEM Lab | Vibrational Spectroscopy Lab |
| Department of ME | Department of Physics | Department of ME |
| IIT Bombay | TU Munich, Germany | IIT Bombay |
| a_jain@iitb.ac.in | david.egger@tum.de | dipanshu@iitb.ac.in |