Vishrant Dave

Third Year Undergraduate, Material Science Engineering
Double Major in Aerospace Engineering
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Research Interests

Solid and Liquid Propulsion, Spacecraft Thermal Control Systems, Computational Fluid Dynamics, Orbital Mechanics and Control Systems, Phase Change Materials and Ultra-high Temperature Ceramics

Education

Year	Degree/ Certificate	Institute	CPI/ %
2023	B.Tech, Material Science and Engineering Double Major, Aerospace Engineering	Indian Institute of Technology, Kanpur	**8.22**/10.0
2019	Higher Secondary Certificate (CBSE XII)	Ryan International School, Mumbai	**95.8%**
2017	Secondary School Certificate (CBSE X)	Ryan International School, Mumbai	**96.6**%

Research Internship

- **Multiphase Numerical Analysis of Latent Heat TES Systems** June 2021 - Aug 2021
  SURGE Research Program, Prof. Ashoke De, AE, IIT Kanpur
  - Carried out literature search on Numerical Methods to simulate the melting and solidification property of **Phase Change Materials** used in latent heat based Thermal Energy Storage Devices
  - Used Enthalpy-Porosity fixed grid technique to model 1-dimensional convection/diffusion Stephan's Problem
  - Studied OpenFOAM heat transfer solvers like buoyantSimpleFoam and buoyantPimpleFoam to understand the **Finite Volume Method** approach for steady-state and transient algorithms respectively
  - Developed a FVM based algorithm in **OpenFOAM** to simulate multiphase behaviour of melting of Phase Change materials. Working on developing algorithm to include Boussinesq and Source Term approximations

Projects

- **High Temperature Behavior of ZrB_2 based UHTCs** Aug 2021 - Ongoing
  Undergraduate Project, Prof. Kantesh Balani, MSE, IIT Kanpur
  - Working on material behavior of **ZrB_2** based Ultra High Temperature Ceramics for Spacecraft applications
  - Studying the oxidation behaviour of diboride and dicarbide based heat shields during **atmospheric reentry**
  - Working alongside Ph.D. mentor to study the **behavior of UHTCs in Martian atmospheric reentry** situation and its material behavior at 95% CO_2 and low temperature Martian environment

- **Two Wheel Self Balanced Robot** May 2021 - July 2021
  Robotics Club, IIT Kanpur
  - **Designed** a complete discrete digital control system with state space model to provide dynamic stability
  - Implemented closed loop control system using **LQR** algorithm to inverted pendulum test case using MATLAB
  - Applied **Kalman Filter** to above algorithm to account for system instabilities and external uncertainties

- **Thermal Stability of Perovskite Solar Cells** June 2021 - Aug 2021
  MSE681A: Solar Energy Technology, Prof. Kanwar Nalwa, MSE, IIT Kanpur *Grade: A**
  - Presented the fundamental reasons for intrinsic thermal instability and breakdown of HTL and ETL layers
  - Analyzed existing solutions to prevent intrinsic thermal degradation by using **Caesium doped PSC**
  - Proposed an innovative way to solve the thermal stability issue by using **PCM** as heat-absorber layer

- **Fuel Gauging in Microgravity using ECVT Sensor** Jan 2021 - May 2021
  AE251A: Experiments in Aerospace Engineering I, Prof. Sudhir Kamle, AE, IIT Kanpur *Grade: A*
  - Studied the potential of Electrical Capacitance Volume Tomography (ECVT) sensor to be used as Fuel Gauge in Microgravity conditions onboard spacecrafts. Essential utility in developing **propellant depots** in orbit.
  - Analysed conventional methods of fuel gauging sensors based on gravity and differential pressure mechanisms
  - Learnt **operating principle and design** of ECVT sensor for collecting experimental data of multi-phase flows

(A: Exceptional Performance, A: Excellent Performance)*

Initiatives

- **Rocket Propulsion Team, IITK** June 2021 - Present
  Founder and Lead Engineer
  - Brought together and formed a 6 member team to establish a **high-power Model Rocketry Club** at IITK
  - Building an Ammonium Perchlorate based Composite Propellant **(APCP)** for our first Celestia 0.3 Rocket
  - Designed CAD on Fusion360 for **parachute deployment** technique by both ejection and mechanical methods
  - Using softwares such as OpenRocket and MATLAB to simulate and predict flight characteristics

Scholastic Achievements

2021 Received **SURGE-IITK** scholarship to pursue funded Summer Research Internship at IIT Kanpur, India
2019 Secured All India Rank **4495** in **JEE Advanced** among **2,00,000** selected candidates
2019 Secured All India Rank **3122** in **JEE Mains** (top **0.1%** Percentile) among **1 Million** candidates

Relevant Coursework

Fluid Mechanics and Rate Processes	Mechanics of Solids	Linear Algebra
Incompressible Aerodynamics	Partial Differential Equations	Dynamics
Solar Energy Technologies and Materials	Rate Processes	Quantum Physics

Skills

- **Tools:** OpenFOAM, Git, MatPlotLib, NumPy, LaTeX, OpenRocket
- **Languages:** Python, C, C++, HTML, CSS, JavaScript
- **Software:** Fusion 360, MATLAB and Simulink, LabView, Autodesk Inventor and AutoCAD
- **Web Development:** VS Code IDE, jQuery, SCSS

Teaching Internship

- **CAMPK12: AI and Machine Learning Instructor** June 2020 - Aug 2020
  Tech Leaders Internship Programme
  - Gained **90+ hours** of experience teaching JAVA/Python based courses to students of diverse age group
  - Contributed in developing a curriculum that helps students connect with real life problems based on ML
  - Developed 8 projects to help students understand concepts better, later added to company repository

Positions of Responsibility

- **Academic Department Mentor** August 2021 - Present
  Material Science and Engineering Department, IITK
  - Responsible to mentor and guide **250+ undergraduate students** regarding Material Science and Engineering Bachelors program, Departmental courses and Undergraduate Research Projects
  - Organized meetings and talk sessions to make students more cognizant of their curriculum and academics
- **Secretary, International Relations Wing** May 2020 - April 2021
  Academics and Career Council, IITK
  - Led development of GRAD: **Graduate Research Application Directory**. A go-to guide about application procedure for postgraduate studies. The initiative witnessed a massive reach of over **8,500 students**
  - Interviewed IITK alumni to understand their experience and journey in postgraduate application, information was later transcribed and used to draft GRAD
  - Spread awareness about International Opportunities through **RISE** Research Internship and Semester Exchange Blog Series reaching **3500+ students** via facebook handle.
- **Junior Executive** Aug 2019 - May 2020
  Entrepreneurship Cell, IITK
  - Organized 19^{th} edition of Startup Master Class with Alumni Association having **1000+** participants
  - Managed Entrepreneurial Lecture Series **Startup101**, an yearlong series of talks by renowned Entrepreneurs
  - Conducted Business Model discussion to promote Entrepreneurship within campus

Extra Curriculars

- Aeromodelling Club Competitions, IITK:
  - Won 2nd prize in Glider Competition
  - Won 3rd prize in Ornithopter Competition
- Developing Personal Website using HTML, CSS, JS
- Served as an NCC Cadet at 2-UP-CTR division
- Language: English, Hindi and Gujarati