

# SAURAV DUTTA

CONTACT INFORMATION	Vizuara AI Labs Pune-411045, India	 Portfolio <a href="#">↗</a> sauravdutta2145@gmail.com
EDUCATIONAL QUALIFICATIONS	<b>National Institute of Technology, Silchar, India</b> Bachelor of Technology (B.Tech.) Civil Engineering Thesis : Static and Dynamic Analysis of Laminated Composite Plates using Finite Element Analysis CGPA : <b>9.03/10 (Top 10%)</b>	(June '19 - June '23)
PUBLICATIONS / BOOK CHAPTERS / CONFERENCES	<ol style="list-style-type: none"><li>1. S. Dutta, V. Anand, "Framework for Ground Motion Characterization," <b>Seismic Hazard Analyses, Wave Propagation &amp; Site Characterization</b>, Springer Nature (2024) <a href="#">↗</a></li><li>2. A. Joshi, S. Dutta, S. Kumar, "Hetero-EUCLID : Simultaneously segmenting and discovering hyperelastic constitutive models of all components of a heterogeneous hyperelastic material using EUCLID," <b>European Solid Mechanics Conference 2025, Lyon, France.</b> <a href="#">↗</a></li><li>3. K. L. Chaurasiya, S. Dutta, S. Kumar, A. Joshi, "Hetero-EUCLID : Interpretable model discovery for heterogeneous hyperelastic materials using stress-unsupervised learning," <b>Computer Methods in Applied Mechanics &amp; Engineering</b> (2025) (Accepted). <a href="#">↗</a></li><li>4. H. K. Sandhu, S. Dutta, R. Chaunsali, "Wave propagation in an elastic lattice with non-reciprocal stiffness and engineered damping," <b>Journal of the Acoustical Society of America</b> (2025) (Minor revision). <a href="#">↗</a></li><li>5. S. Singh, M. Kumar, S. Dutta, V. Anand, "Identification of critical ground motion features for seismic fragility studies considering soil-structure interaction," <b>Journal of Vibration Engineering &amp; Technologies</b> (2025) (submitted).</li></ol>	
INTERNATIONAL COLLABORATION	<b>Inverse Design of Granular Solids using generative models</b> <a href="#">↗</a> Advisor : Prof. Konstantinos Karapiperis, <b>École Polytechnique Fédérale de Lausanne</b>	(July '25 - Present)
	<ul style="list-style-type: none"><li>• Synthesized insights from recent studies on architected granular lattices to identify gaps in mechanical modeling, motivating a data-driven framework for inverse lattice design.</li><li>• Developed a Python-based automated pipeline to generate and catalog over <b>10,000+</b> 3D lattice datasets having periodicity and fully-dense structure.</li><li>• Established a comprehensive dataset forming the foundation for training a generative model, such as a diffusion model, toward inverse mapping of architected granular lattices.</li></ul>	
PROFESSIONAL EXPERIENCE	<b>Indian Institute of Technology BHU, Varanasi</b> <a href="#">↗</a> Summer Research Intern, Dept. of Civil Engineering, Advisor : Prof. Vishwajit Anand	(May '22 - July '22)
	<ul style="list-style-type: none"><li>• Developed a MATLAB-based framework to characterize seismic records and identify seismic parameters most sensitive to structural response under earthquake loading.</li><li>• Processed 195 seismic records from the PEER Database, extracting and computing over <b>30+</b> intensity measures, including PGA, PGV, PGD, Arias intensity.</li><li>• Utilised the OpenSeismoMatlab framework to automate Fourier and elastic response spectral analyses, determining predominant periods (<math>T_p = 0.1 - 2.4</math> s) and pseudo-accelerations (2.9 – 13.3 m/s<sup>2</sup>), providing a basis for fragility assessment and parameter sensitivity evaluation.</li></ul>	
	<b>Indian Institute of Science, Bengaluru</b> <a href="#">↗</a> Research Associate, Dept. of Mechanical Engineering, Advisor : Prof. Akshay Joshi <a href="#">↗</a>	(June '23 - July '25)
	<ul style="list-style-type: none"><li>• Investigated automated model discovery for heterogeneous hyperelastic materials by extending the EUCLID framework, originally developed for homogeneous systems.</li><li>• Developed a Python-based probabilistic growth algorithm with interpretable priors to detect and track heterogeneous material interfaces, achieving <b>98–99%</b> segmentation accuracy.</li><li>• Implemented Bayesian-EUCLID with <b>2–10%</b> MCMC sub-sampling over 10,000–21,000 C3D6 nodes, predicting local material parameters with <b>1–3%</b> mean error.</li><li>• Validated the resulting Hetero-EUCLID method on 3D non-equi-biaxial tension tests (<math>\lambda_x = 1.6, \lambda_y = 2.2</math>), demonstrating noise robustness and interpretable constitutive model recovery.</li></ul>	

Research Assistant, Dept. of Aerospace Engineering, Advisor : Prof. Rajesh Chaunsali ↗

- Investigated the design of non-reciprocal elastic lattices to realize unidirectional wave propagation through non-reciprocal stiffness and non-reciprocal damper.
- Developed a MATLAB-based framework to derive complex dispersion relations for an infinite lattice with asymmetric springs ( $\alpha = 0.1$ ) and dampers ( $\beta = \pm 0.2$ ), and validated these predictions using finite-chain simulations of 200 oscillators with  $< 2\%$  deviation.
- Demonstrated unidirectional wave amplification with a growth rate of  $0.71 \text{ s}^{-1}$ , confirming non-reciprocal energy transport and validating the theoretical model.

### Vizuara AI Labs, Pune, India

(Sept '25 – Present)

Research Scientist, Principal Investigator : Dr. Sreedath Panat

- Engaged in research on Scientific Machine Learning (SciML) and Physics-informed AI, with a focus on developing interpretable and data-efficient learning frameworks for scientific systems.
- Working on a Universal Differential Equation (UDE) framework to infer micro-scale material properties, such as alloy behavior, by combining mechanistic models with neural components.
- Exploring extensions of these methods toward foundation models for physical systems and the integration of LLMs, reinforcement learning (RL).

### SCHOLASTIC ACHIEVEMENTS

- Maintained **9.58/10 Cumulative GPA** considering all core courses from 3<sup>rd</sup> - 8<sup>th</sup> semester
- **AA** grade in Bachelor's Thesis I and II, 2023
- **AA** grade in **17** out of **27** departmental courses, 2023
- Selected for Undergraduate Research Council Funded Project (UGRC), NIT Silchar, 2022
- Achieved **2<sup>nd</sup>** rank institute-wide and in the department in 4<sup>th</sup> semester with **9.93/10** GPA

### THESIS PROJECTS

#### Static and Dynamic Analysis of Laminated Composite Plates under Thermal Effects using Finite Element Simulation ↗

(Jan '23 - May '23)

Advisor : Prof. Atanu Sahu, Dept. of Civil Engineering, **NIT Silchar**

- Developed FEA models of 10-layer, 5 mm laminated graphite composite plates in ABAQUS to study their static and vibrational behavior under thermal loading.
- Performed static simulations across multiple lamination sequences and boundary conditions over 300-400 K, computing deflection (**1.42 mm**) and von Mises stress (**82 MPa**).
- Conducted dynamic analysis to determine natural frequencies and mode shapes, capturing temperature-dependent shifts in the vibrational response.
- Identified significant thermo-mechanical coupling effects, including up to **12%** frequency reduction and **15%** stiffness degradation, demonstrating the influence of fiber orientation and temperature on structural stability.

#### Design and Analysis of G+4 Residential Structure ↗

(Aug '22 - Dec '22)

Advisor : Prof. Subhrajit Dutta, Dept. of Civil Engineering, **NIT Silchar**

- Performed structural design and analysis of a G+4 reinforced concrete building (15 m × 25 m × 20 m) situated in Seismic Zone V, incorporating dead, live, wind (33 m/s) and seismic loads in accordance with Indian Standard (IS) codes.
- Developed frame models with 300×300 mm columns, 300×350 mm beams, and 140 mm slabs, and analyzed the structure using the Substitute Frame Method, obtaining base reactions up to 46.7 kN and bending moments up to 22.2 kNm/m.
- Designed slabs, beams, columns, footings, and staircases (200 mm waist slab, 10 mm bars @ 220 mm c/c) ensuring  $l/d < 33.8$ , FOS  $> 2.5$ , and full compliance with IS serviceability and ductility criteria, thereby confirming the building's safety and stability under seismic loading.

**Experimental Realisation of Non-linear Pendulums in 1-DOF**  (*June '23 - July '24)*  
Advisor : Prof. Rajesh Chaunsali, Indian Institute of Science, Bengaluru

- Developed an experimental framework to realize non-linear pendulums in a 1-DOF mechanical oscillator for studying non-stationary dynamic behavior.
- Designed and fabricated custom motor hubs and magnet-embedded discs, enabling tunable magnetic interactions between the 3 pendulums.
- Implemented a custom Python control framework to synchronize 3 Dynamixel motors with <1% error in speed and position and generate controlled stiffness modulation.
- Observed tunable stiffness modulation from the data captured using high resolution DIC (240 fps) and LDV, developing a foundation for non-linear dynamical system.

**Stress Analysis in a Truss System using Finite Element Method** (*Jan '23 – Apr '23)*  
Course : Finite Element Method, National Institute of Technology, Silchar

- Performed stress analysis of a 2D plane truss using the FEM, with a 25-element, 16-node model developed in MATLAB to evaluate structural response under a 100 kN load.
- Implemented element-level stiffness formulation to compute nodal displacements and axial stresses across all members, validating the stress distribution.
- Conducted mesh-convergence analysis for an aluminum truss ( $E = 70 \text{ GPa}$ ,  $A = 900 \text{ mm}^2$ ), determining a maximum axial stress of **115 MPa** and tip deflection of **2.4 mm**.

INVITED TALKS      **Guest Lecture : Wave Propagation AE 351A**, Indian Institute of Science, Bengaluru      (*Nov '23)*

- Delivered an invited research lecture in the Department of Aerospace Engineering, introducing non-reciprocity and demonstrating the mechanical skin effect to a graduate cohort.

TECHNICAL  
SKILLS

**Programming Languages** : C, C++, Python, Julia, HTML, CSS  
**Scientific Softwares** : MATLAB, ABAQUS, AutoCAD, COMSOL, Mathematica, CATIA  
**Libraries & Frameworks** : PyTorch, NumPy, SciPy, scikit-learn, Matplotlib, PyVista, OpenCV, Pandas, SymPy, Abaqus Python (scripting), Seaborn  
**Hardwares** : Motor Control, Arduino, Sensors, U2D2, LDV, 3D Printing

RELEVANT  
COURSE WORK

**Mechanics, Structures & Design :-** Engineering Mechanics • Mechanics of Materials • Structural Analysis I, II & III • Deesign of Concrete Structures I & II • Design of Steel Structures • Advanced Structural Analysis • Numerical Methods in Engineering • Finite Element Method • Earthquake Resistant Design of Structures • Concrete Technology

**Fluids & Hydraulics :-** Fluid Mechanics • Hydraulics • Surface and Ground Water Hydrology • Water Supply Engineering • Environmental Engineering

**Audited Miscellaneous :-** Plates & Shells<sup>1</sup> • Vibrations<sup>2</sup> • Wave Propagation in Designed Materials<sup>3</sup> • Quantum Mechanics-I<sup>3</sup> • Condensed Matter Physics-I<sup>3</sup>

WORKSHOP  
AND LABS

**CISM-IISc Workshop :-** Served as a volunteer, contributing to the smooth execution of the workshop through coordination, technical support, and participant engagement on July 2025.  
**NITS Workshop and labs :-** Mechanical Engineering Workshop, Structural Engineering Lab, Fluid Mechanics Lab, Computer Aided Design & Lab.

LEADERSHIP  
ACTIVITIES

**Social**  
• Head, Razzmatazz – Incandescence, NIT Silchar, 2023  
• Head, School Genius – Tecnoesis, NIT Silchar, 2022

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<sup>1</sup> CDEEP IIT Bombay    <sup>2</sup> Master's course NIT Silchar    <sup>3</sup> IISc Bengaluru