

SAURAV DUTTA

CONTACT INFORMATION	Vizuara AI Labs Pune-411045, India	 Portfolio ↗ sauravdutta2145@gmail.com
EDUCATIONAL QUALIFICATIONS	National Institute of Technology, Silchar, India Bachelor of Technology (B.Tech.) Civil Engineering Thesis : Static and Dynamic Analysis of Laminated Composite Plates using Finite Element Analysis CGPA : 9.03/10 (Top 10%)	(June '19 - June'23)
PUBLICATIONS/ BOOK CHAPTERS/ CONFERENCES	<ol style="list-style-type: none">1. S. Dutta, V. Anand, "Framework for Ground Motion Characterization," Seismic Hazard Analyses, Wave Propagation & Site Characterization, Springer Nature (2024) ↗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," European Solid Mechanics Conference 2025, Lyon, France. ↗3. K. L. Chaurasiya, S. Dutta, S. Kumar, A. Joshi, "Hetero-EUCLID : Interpretable model discovery for heterogeneous hyperelastic materials using stress-unsupervised learning," Computer Methods in Applied Mechanics & Engineering (2025) (Accepted). ↗4. H. K. Sandhu, S. Dutta, R. Chaunsali, "Wave propagation in an elastic lattice with non-reciprocal stiffness and engineered damping," Journal of the Acoustical Society of America (2025) (Accepted). ↗5. S. Singh, M. Kumar, S. Dutta, V. Anand, "Identification of critical ground motion features for seismic fragility studies considering soil-structure interaction," Journal of Vibration Engineering & Technologies (2025) (submitted).	
INTERNATIONAL COLLABORATION	Inverse Design of Granular Solids using generative models ↗ Advisor : Prof. Konstantinos Karapiperis, École Polytechnique Fédérale de Lausanne	(July '25 - Present)
	<ul style="list-style-type: none">• Synthesized insights from recent studies on architected granular lattices to identify gaps in mechanical modeling, motivating a data-driven framework for inverse lattice design.• Developed a Python-based automated pipeline to generate and catalog over 10,000+ 3D lattice datasets having periodicity and fully-dense structure.• Established a comprehensive dataset forming the foundation for training a generative model, such as a diffusion model, toward inverse mapping of architected granular lattices.	
PROFESSIONAL EXPERIENCE	Indian Institute of Technology BHU, Varanasi ↗ Summer Research Intern, Dept. of Civil Engineering, Advisor : Prof. Vishwajit Anand	(May '22 - July '22)
	<ul style="list-style-type: none">• Developed a MATLAB-based framework to characterize seismic records and identify seismic parameters most sensitive to structural response under earthquake loading.• Processed 195 seismic records from the PEER Database, extracting and computing over 30+ intensity measures, including PGA, PGV, PGD, Arias intensity.• Utilised the OpenSeismoMatlab framework to automate Fourier and elastic response spectral analyses, determining predominant periods ($T_p = 0.1 - 2.4$ s) and pseudo-accelerations (2.9 – 13.3 m/s²), providing a basis for fragility assessment and parameter sensitivity evaluation.	
	Indian Institute of Science, Bengaluru ↗ Research Associate, Dept. of Mechanical Engineering, Advisor : Prof. Akshay Joshi ↗	(June '23 - July '25)
	<ul style="list-style-type: none">• Investigated automated model discovery for heterogeneous hyperelastic materials by extending the EUCLID framework, originally developed for homogeneous systems.• Developed a Python-based probabilistic growth algorithm with interpretable priors to detect and track heterogeneous material interfaces, achieving 98–99% segmentation accuracy.• Implemented Bayesian-EUCLID with 2–10% MCMC sub-sampling over 10,000–21,000 C3D6 nodes, predicting local material parameters with 1–3% mean error.• Validated the resulting Hetero-EUCLID method on 3D non-equi-biaxial tension tests ($\lambda_x = 1.6, \lambda_y = 2.2$), demonstrating noise robustness and interpretable constitutive model recovery.	

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 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 3rd - 8th 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 **2nd** rank institute-wide and in the department in 4th 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, CA-TIA
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 & Shells¹ • Vibrations² • Wave Propagation in Designed Materials³ • Quantum Mechanics-I³ • Condensed Matter Physics-I³

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

¹ CDEEP IIT Bombay ² Master's course NIT Silchar ³ IISc Bengaluru