SARTHAK SHRIVASTAVA

sarthaks20.github.io | sarthakshrivastava | sarthak.iitd23@gmail.com | (+91)-903-966-0358

EDUCATION

Indian Institute of Technology Delhi, India *2019 - 2023*
Bachelor of Technology (B.Tech.), Civil Engineering *GPA: 8.283/10.0*

AREAS OF INTEREST

Computational Structural Mechanics, Continuum Mechanics, Finite Element Methods, Multi-scale and Multi-physics Modeling, Peridynamics, Structural Dynamics, Structural Health Monitoring, Scientific Machine Learning

RESEARCH EXPERIENCE

Undergraduate Researcher | *Multiphysics & Multiscale Mechanics Research Group, IIT Delhi* (*Sep, 2022 - Jun, 2023*)
- Conducting numerical simulations using finite element and peridynamics methods to investigate the role of indenter geometry on indentation-induced damage of glasses under the supervision of Prof. N. M. Anoop Krishnan

Summer Undergraduate Research Fellow | *Industrial Research & Development Unit, IIT Delhi* (*May, 2021 - Oct, 2021*)
- Worked on a summer research project titled 'The Application of Machine Learning to Structural Health Monitoring' under the supervision of Prof. Sahil Bansal, funded by the Industrial Research & Development (IRD) Unit, IIT Delhi

PROJECTS

Investigating Indentation Size Effect in Glasses using Computational Methods (*Sep, 2022 - Present*)
Advisor: Prof. N. M. Anoop Krishnan, IIT Delhi
- Conduct in-depth numerical simulations employing **finite element** and **peridynamics** techniques to analyze the influence of indenter geometry on glass **indentation-induced damage**
- Develop a comprehensive damage model for glass indentation, including crack initiation, propagation, and fragmentation; investigate the **indentation size effect** by varying loads and indenter tip angles to understand glass behavior
- Utilize **machine learning** to predict glass mechanical properties, particularly hardness, based on composition, indenter tip angle, and load, fostering a deeper understanding

Stability of Steel Columns at Elevated Temperatures | *Finite Element Analysis* (*Nov, 2022 - Dec, 2022*)
Advisor: Prof. Vasant Matsagar, IIT Delhi
- Eigen value problem to determine the **buckling load** through FE formulation showed convergence with Euler's formula
- Stresses were evaluated under **thermo-mechanical loading** for various boundary conditions of the column
- Performed **non-linear analysis** of columns using **Riks analysis**; determined **critical thermo-mechanical stresses** and facilitated the performance of **post-buckling analysis** until collapse

The Application of Machine Learning to Structural Health Monitoring | *UROP* (*May, 2021 - Oct, 2021*)
Advisor: Prof. Sahil Bansal, IIT Delhi
- Devised a **vibration-based damage-detection** approach using **AI methods** on time response simulated data
- Extracted different **damage-sensitive features** based on **signal statistics** and **modal properties**; analyzed **signal response time-series** using **AR and ARX models**; proposed **statistical model for feature discrimination**
- Ranked damage-sensitive features and employed **support vector machines** to classify **structural condition states**

Transverse Vibration Analysis of Euler-Bernoulli Beam | *Computational Mechanics* (*Mar, 2022 - Apr, 2022*)
Advisor: Prof. Prapanch Nair, IIT Delhi
- Derived an **explicit finite difference scheme** with **second order accuracy** by discretizing the governing equations
- Implemented Python script for computation of **natural frequencies** of vibration, **mode shapes**, and **vibration response** of the elastic beam for **different boundary conditions**, viz. fixed-fixed, fixed-pinned, pinned-pinned, and fixed-free
- **von Neumann analysis** was done to establish **stability requirements** of the solution, explicit FD scheme was found to be **conditionally stable** and **convergent**; compared the results with analytical solution to validate the approach

Structural Design using STAAD.Pro | *Structural Design & Detailing* (*Aug, 2022 - Nov, 2022*)
- Designed and analyzed the structures of **hostel campus** comprising five blocks of **G+10 storey buildings**, **reinforced concrete overhead water tank**, **industrial shed truss**, and **transmission tower** using AutoCAD and STAAD.Pro
- Resistance to **earthquake** and **wind loads** were incorporated into the structural design process as per Indian Standards

PUBLICATIONS & PRESENTATIONS

- *The Role of Indenter Geometry on Indentation-Induced Damage of Silica Glass using Peridynamics*, ACerS GOMD Annual Meeting, LA, United States. Jun 2023. [Abstract accepted]
- *Impact Studies with Peridynamics*, Civil Engineering Seminar, Indian Institute of Technology, Delhi, India. Apr 2022.

TEACHING & MENTORING EXPERIENCE

Tutor | *Course Hero, Inc.* (*Dec, 2021 - Apr, 2023*)
- Offered online tutoring to students seeking academic assistance in Physics, Mathematics, and Civil Engineering
- Received **consistently positive ratings** and feedback from students for effectiveness and clarity of instruction

Academic Mentor | *Board of Student Welfare (BSW), IIT Delhi* (*Nov, 2020 - Feb, 2021*)
- Provided **peer mentorship** and tutoring to undergraduate freshers in **Engineering Mechanics** (APL100) course
- Assisted the students to acclimate to a new academic setting by **facilitating weekly study sessions**

Educator (IIT-JEE Physics) | *Unacademy* (*Aug, 2020 - Oct, 2020*)
- Taught Advanced Physics to **500+ IIT-JEE aspirants**; held interactive sessions and emphasized **analytical thinking**, **problem-solving** and **exam-taking** skills through the use of **visual learning** approaches; offered learning resources
- Ranked among **top 100 educators** in IIT-JEE category with over **15K minutes** of watch time on online platforms

Mentor | *Project Aarohan, National Service Scheme (NSS), IIT Delhi* (*Sep, 2019 - Apr, 2020*)
- Mentored underprivileged students of class XI and XII for competitive exams
- Taught Physics; provided them with comprehensive study material and conducted doubt clearing sessions

WORK EXPERIENCE

Machine Learning Engineer | *Sirion* (*Aug, 2023 - Present*)
- Developing and deploying **ML pipelines** for **NLP** based **document understanding**, such as metadata extraction, summarization, and analysis; using frameworks and libraries such as PyTorch, Flask, SpaCy, Weaviate and Transformers
- Implemented context service for **LLM based chatbot** integrated to SirionONE, leveraging **LLAMA** and **GPT** frameworks, to provide intelligent assistance to users, achieving high scalability using **multi-threaded message queuing**

Summer Analyst | *Axis Bank (Business Intelligence Unit)* (*Jun, 2022 - Jul, 2022*)
- Built a **web-scraping tool** that extracts information related to employees' salaries, revenues, capitals of an organization
- Employed **Selenium** to **automate web browser** and interact with **dynamic web pages**; handled **captcha recognition** through **OpenCV** based **character segmentation** technique; analyzed the scraped data to gain useful **business insights**
- Developed tool is capable of scraping data of **600K+ organizations**; proposed ideas to **amplify sales** of salary accounts

TECHNICAL SKILLS

- **Programming Languages:** Python, C++, Java, Julia, MATLAB
- **Software & Tools:** Git, Docker, High Performance Computing, STAAD.Pro, Abaqus, Ansys, LaTeX, Microsoft Office
- **Libraries:** PyTorch, OpenCV, Pandas, NumPy, SciPy, Matplotlib, Scikit-learn, Transformers, Peridigm, Selenium

SCHOLASTIC ACHIEVEMENTS

- Awarded the **Summer Undergraduate Research Award (SURA), 2021** from Industrial R&D Unit, IIT Delhi *2022*
- **Online Judges:** Scored **5-star rating** on ***HackerRank*** and **3-star (max. 1783 rating)** on ***CodeChef*** *2021*
- **JEE (Advanced):** Secured **All India Rank 1841 (top 1 percentile)** among 0.17 million candidates *2019*
- **JEE (Main):** Achieved **All India Rank 1403 (top 0.1 percentile)** among 1.2 million candidates *2019*
- **KVPY:** Awarded fellowship for showcasing excellence in scientific aptitude and research potential by DST, GoI *2018*

REFERENCES

Dr. N. M. Anoop Krishnan
Associate Professor
Department of Civil Engineering
Indian Institute of Technology Delhi
krishnan@civil.iitd.ac.in
https://sites.google.com/site/nmakrishnaniitd/
+91-11-2659-1223

Dr. Vasant Matsagar
Professor
Department of Civil Engineering
Indian Institute of Technology Delhi
matsagar@civil.iitd.ac.in
http://www.matsagar.org/
+91-11-2659-1225

Dr. Sahil Bansal
Assistant Professor
Department of Civil Engineering
Indian Institute of Technology Delhi
sahil@civil.iitd.ac.in
https://sites.google.com/view/sahilbansal/
+91-11-2654-8414

Dr. Prapanch Nair
Assistant Professor
Department of Applied Mechanics
Indian Institute of Technology Delhi
pnair@am.iitd.ac.in
https://web.iitd.ac.in/~pnair
+91-11-2659-1226