MEER MEHRAN RASHID

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EDUCATION:

PhD	Civil and Systems Engineering Department Johns Hopkins University, Baltimore, USA	2023-present
Master of Science-Research (MS-R)	Structural Engineering, Civil Engineering Department, Indian Institute of Technology Delhi, India CGPA - **9.75/**10	2021- 2023
Bachelor of Technology	Civil Engineering Department, National Institute of Technology Srinagar, India CGPA- **8.75/**10	2016-2020

RESEARCH INTEREST:

My primary research focus is at the intersection of Scientific Machine Learning and Computational Solid Mechanics, dedicated to developing Deep Learning Surrogates to tackle computationally intensive problems. I specialize in using **Neural Operators**, **Generative Models**, and **Physics-Informed Neural Networks (PINNs)** to accelerate high-fidelity simulations. Currently, my work focuses on capturing **heterogeneous and path-dependent responses** for elastoplastic materials, as well as modeling **history-dependent responses** in phase-field fracture models.

PhD PROJECTS: **Supervisor: Prof. Lori Graham Brady**

- **Hybrid Framework for Stress Prediction in Hyperelastic Materials**
  This project involved developing the cDDPM–DeepONet hybrid framework to accurately predict stress fields in hyperelastic materials with complex microstructures. The methodology decouples stress prediction by using a Conditional Denoising Diffusion Probabilistic Model (cDDPM) for high-fidelity normalized stress morphology and a DeepONet for predicting global scaling parameters (min/max von Mises stress).

- **Stress Evolution in Elasto-Plastic Materials**
  The current objective is to develop machine learning models capable of accurately predicting stress/strain evolution in elasto-plastic materials when subjected to complex, non-linear load paths.

- **Benchmarking Deep Learning Surrogates for Phase Field Fracture (PFF)**
  This work focused on conducting a systematic comparison of machine learning models for accelerating computationally expensive Phase Field Fracture (PFF) simulations. Five state-of-the-art surrogates were benchmarked, including FNO, DeepONet, Latent DeepONet, UNet, and Diffusion Models.

MASTER'S THESIS PROJECT:

Department of Civil Engineering
Indian Institute of Technology Delhi, India

Supervisor(s) :- Prof. N.M. Anoop Krishnan & Prof. Souvik Chakraborty

- Estimating the mechanical response of 2D digital composites using Deep Learning Methods.
- Using Neural Operators (FNO-Fourier Neural Operator, DeepONet, MWT-Multiwavelet - Transform, Wavelet Neural Operator) to predict the temporal stress strain evolution until the onset of fracture for composites.
- Optimizing the material geometry for a specific target property using different optimization methods

UNDERGRADUATE THESIS PROJECT:

Department of Civil Engineering, **Supervisor :-** Prof. Fayaz Sofi,
National Institute of Technology Srinagar, India

- Analysing the '*effect of corrugations on the patch load capacity of steel girders'* on the overall shear capacity of the corrugated girders
- Created numerical models to correlate the shear capacity of flat and corrugated web steel girders.
- We developed ML models to predict the patch load capacity of corrugated web girders.

JOURNAL PUBLICATIONS

- '*Learning the Stress-Strain fields in Digital composites using Fourier Neural Operator*.' **Meer Mehran Rashid**, Tanu Pittie, Souvik Chakraborty, N.M. Anoop Krishnan- iScience-CellPress https://doi.org/10.1016/j.isci.2022.105452

- *'Estimating the Strain Field Evolution in Digital Composites using Neural Operators'* **Meer Mehran Rashid**, Souvik Chakraborty, N.M. Anoop Krishnan- Journal of the Mechanics and Physics of Solids https://doi.org/10.1016/j.jmps.2023.105444

- *'CoDBench: a critical evaluation of data-driven models for continuous dynamical systems"* Priyanshu Burak, Karn Tiwari, **Meer Mehran Rashid,** Pratosh A.P, N.M. Anoop Krishnan- Digital Discovery https://doi.org/10.1039/D4DD00028E

- "*Prediction of surface and different depth amplifications of deep soil sites for potential scenario earthquakes"* P. Anbazhagan, Mohammad Rafiq Joo, **Meer Mehran Rashid**, Nassir S.N. Al-Arifi; Natural Hazards https://doi.org/10.1007/s11069-021-04670-4

CONFERENCES AND BOOK CHAPTERS

- 'A Hybrid Neural Operator and Conditional Diffusion Framework for Predicting Hyperelastic Material Response' ***Meer Mehran Rashid****, P V Kota, S Goswami, Lori Graham Brady- USNCCM 2024*

- 'Learning the Stress-Strain fields in Digital composites using Fourier Neural Operator.' **Meer Mehran Rashid**, Tanu Pittie, Souvik Chakraborty, N.M. Anoop Krishnan- MRS-Fall-2022

- 'Predicting the Strain field evolution in 2D-Digital Composites using Neural Operators' **Meer Mehran Rashid**, Souvik Chakraborty, N.M. Anoop Krishnan- MRS-Spring-2023

- State-wise Prediction of Surface PGA over Indo-Gangetic Basin for Different Scenario Earthquakes Considering Site Response Studies**.** Anbazhagan P, Mohammad Rafiq Joo, **Meer Mehran Rashid** and Ketan Bajaj DOI: 10.1007/978-981-15-9984-2_5

REFERENCES:

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