Indrashish Saha

Contact Information

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Research interests

Crystal Plasticity Finite Element, Fracture Mechanics, Damage Mechanics
Machine Learning, Data-driven Models, Surrogate Models

Research Experience

Johns Hopkins University, Baltimore, USA
Ph.D. Thesis — August 2021-Present

- Working on micro-inertia based data-driven damage model for materials under dynamic loading conditions.
- Developed cohesive zone insertion tool in Python to insert zero-thickness cohesive zone elements at every element boundary in a regular or irregular mesh for dynamic fracture applications in polycrystalline materials.
- Developed a crystal plasticity (CP) model for the plate impact experiment (at strain rates of $\sim 10^6 s^{-1}$) of polycrystalline materials. The model incorporates cohesive zones at the grain boundaries to allow fracture of the microstructures at grain boundaries under dynamic loading. The CP model is capable of taking into account the thermally activated mechanisms along with a viscous drag effect which is important for the strain-rate levels considered in the model. Additionally developed a data-driven model to predict the spall fracture in metals under shock loading using neural operators.
- Developed a data-driven model to predict the nonlinear plastic behavior of two-phase fiber-reinforced composites using $3D$ Convolutional layers in a U-Net structure. The model captures the loading and unloading of the microstructure in a given complex loading condition. The model generates the stress and strain maps of a given composite in a fraction of the time taken by traditional finite element methods.
- Advisor: Dr. Lori Graham-Brady, Professor, Department of Civil and Systems Engineering, JHU

Indian Institute of Science, Bangalore, India
M.Tech (Research) Thesis — December 2019-2021

- Worked on the statistical analysis of Acoustic Emission waveforms emitted from Steel fiber reinforced concrete (SFRC) under multiple loading condition and developed a machine learning method to characterize fracture processes in SFRC.
- Advisor: Dr. R. Vidya Sagar, Principal Research Scientist, Department of Civil Engineering, IISc Bangalore

Education

Johns Hopkins University, Baltimore, USA
PhD in Mechanics of Materials — 2021-Present

- Department of Civil Engineering and Systems Engineering
- Current Cumulative GPA: **3.90 out of 4**.

Indian Institute of Science, Bangalore, India
M.Tech (Research) in Structural Engineering — 2019-2021

- Department of Civil Engineering
- Cumulative GPA: **8.60 out of 10**.

Jadavpur University, Kolkata, India
B.E. in Civil Engineering — 2014-2018

- Cumulative GPA: **8.22 out of 10**.

Publications

- **Indrashish Saha** and Lori Graham-Brady (2026) Numerical and data-driven modeling of spall failure in polycrystalline ductile materials *Computer Methods in Applied Mechanics and Engineering* (Elsevier) [I.F. = 6.9]
- Ishan Khurjekar,**Indrashish Saha**, Lori Graham-Brady, Somdatta Goswami (2025) Enhanced accuracy through ensembling of randomly initialized auto-regressive models for time-dependent PDEs *arXiv* (Preprint) [Accepted]
- **Indrashish Saha**, Ashwini Gupta, Lori Graham-Brady, (2023) Prediction of local elasto-plastic stress and strain fields in a two-phase composite microstructure using a deep convolutional neural network *Computer Methods in Applied Mechanics and Engineering* (Elsevier) [I.F. = 6.9]
- **Indrashish Saha** and R. Vidya Sagar, (2022) Statistical analysis of acoustic emission avalanches generated during the compressive fracture process, and Mode I fracture process in cementitious composites. *International Journal of Fracture* (Springer) [I.F. = 2.7]
- **Indrashish Saha** and R. Vidya Sagar (2021) Classification of the acoustic emissions generated during the tensile fracture process in steel fibre reinforced concrete using a waveform-based clustering method, *Construction and Building Materials* (Elsevier) [I.F. = 7.4]

Conference Presentations

- "Data-driven surrogate model for high velocity impact of polycrystalline metals" at *18th U.S. National Congress on Computational Mechanics*, 2025, Chicago, Illinois, USA.
- "Deep learning based accelerated high strain rate simulations for design of materials in extreme environments" at *16th World Congress on Computational Mechanics / 4th Pan American Congress on Computational Mechanics*, 2024, Vancouver, BC, Canada.
- "Deep learning based accelerated high strain rate simulations for design of materials in extreme environments" at *Society of Engineering Science (SES) - Annual Technical Meeting*, 2023, Minneapolis, USA.
- "Prediction of Stress Field in Fiber-Reinforced Composites Using 3D U-Net Under Cyclic Loading Conditions" at *10th International Conference on Multiscale Materials Modeling*, 2022, Baltimore, USA.

Relevant Coursework

- Continuum Mechanics
- Continuum Plasticity
- Mechanical Properties of Materials
- Non-linear Optimization
- Deep Learning
- Finite Element Methods

Technical Skills

- Programming language: Fortran, Python, C++
- ML/DL libraries: PyTorch, TensorFlow, JAX
- Software: Abaqus (UMAT/VUMAT),MATLAB, FEniCS

Achievements

- Received the **best poster award** at Hopkins Extreme Materials Institute (HEMI) day symposium, 2026.
- Received a **travel award** for the USNCCM-18 conference in 2025.
- Received the **P.S. Narayana Medal** for "Best M.Tech Research Thesis" at the **Indian Institute of Science, Bangalore** in 2024.
- Got **99.38 percentile** in **GATE** 2019 out of over 1.2 million candidates.
- Ranked **19** in **Presidency University Entrance Test for Chemistry** 2014 out of over 3,500 candidates.