Mayank Gupta

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Education

- **The University of Tokyo** Tokyo, Japan
Doctor of Philosophy (Ph.D.) Sept. 2019- Sept. 2022

Thesis Title: *Study on mechanical properties and multiscale expansion modelling for concrete with expansive additives under different restraint conditions using Poro-mechanics*.
(Advisors: Prof. Tetsuya Ishida, Dr. Go Igarashi, Dr. Yuya Takahashi)

- **Indian Institute of Technology (IIT), Delhi** New Delhi, India
Masters of technology, Structural Engineering Aug. 2017- May 2019
Accolades: Ranked 2 in the batch with CGPA of 9.22/10

Thesis Title: *Multiscale modeling of strength of concrete using analytical homogenisation and damage mechanics*.
(Advisor: Prof. Shashank Bishnoi)

- **Indian Institute of Technology (IIT-BHU), Varanasi** Varanasi, India
Bachelors of technology, Civil Engineering Aug. 2013- May 2017
Accolades: Ranked 2 in the batch with CGPA of 9.01/10

Thesis Title: *Determination of optimum mix design parameters for pervious concrete for adequate strength and permeability.*
(Advisor: Prof. Veerendra Kumar)

Research Experience

- **Postdoctoral Researcher, Karlsruhe Institute of Technology** Karlsruhe, Germany
Sustainable concrete pavements using high volumes of construction, demolition, and industrial waste as constituent replacement From Feb. 2025

  - Development of a multiscale analytical modeling framework (Multipy) for upscaling concrete properties from nano to macro scale.
  - Utilizing ML models to optimize strength, cost and carbon footprint.

Coupled chemo-mechanical simulation of ASR in concrete for nuclear plants and radioactive waste management

  - Development of discrete element models (LEMpy) and merging with reaction transport models to understand the underlying mechanism of ASR

- **Postdoctoral Researcher, Delft University of Technology** Delft, Netherlands
Numerical simulation of reaction, microstructure, and volume stability of novel cements for carbon capture storage Feb. 2023 – Dec. 2024

  - Developed reaction and microstructure development model (GeoMicro3D) and reaction transport framework (ReacSan) for rock-based alkali-activated material (AAM) for microstructural changes due to exposure to supercritical CO2

- **Postdoctoral Researcher, The University of Tokyo** Tokyo, Japan
Anisotropic expansion of concrete with CSA additives and microstructural changes due to restraint Nov. 2022- Jan 2023

- **PhD scholar, The University of Tokyo** Tokyo, Japan

Multiscale modelling of expansive concrete and its expansion characteristics under restrained conditions Sept. 2019-Sept. 2022

- Investigated the expansion characteristics of expansive concrete using experiments under both isotropic (tri-axial) and anisotropic restraint
- Developed a chemo-mechanical expansion model for concrete with expansive additives using poro-mechanics and micromechanical schemes with implementation in DuCOM-COM3 system.

Mechanical properties of the cement paste with expansive additives under different restraint conditions

- Enhanced the existing modulus measurement technique (EMM-ARM) to measure the unrestrained and restrained modulus of cement paste with EA.

- **Masters, IIT Delhi** New Delhi, India

Analytical modeling of strength of concrete using micromechanics and damage mechanics Feb. 2018- May 2019

- Developed a multiscale model for concrete's elastic properties, considering the Interfacial Transition Zone (ITZ) gradient and utilizing damage mechanics to model nonlinear behavior within the ITZ layers.

- **Research assistant, Bundeswehr University Munich** Munich, Germany

Effect of calcined clay as supplementary cementitious material (SCM) on the mechanical properties May-July 2016

- **Bachelors, IIT-BHU Varanasi** Varanasi, India

Optimum mix design parameters for Pervious concrete with adequate strength and permeability July 2016-May 2017

Teaching Experience

- **Teaching Assistantship, IIT Delhi** New Delhi, India

Structural analysis, Structure analysis (Lab.) July 2017-May 2018

- **Teaching Assistantship, IIT-BHU Varanasi** Varanasi, India

Design of Steel Structures, Drawing and detailing of Steel Structures July 2016-May 2017

- **Teaching, Karlsruhe Institute of Technology** Karlsruhe, Germany

Micromechanics of composite materials, Multiphysics modeling in concrete

Student Supervision

- Christa Winterman (2023-2024) - Understanding the Mechanism of Drying Shrinkage in Alkali-Activated Binders
- Ahmed Farahat (2024-2025) - Investigating the Carbonation Properties of One-Part Geopolymer (slag and bio-mass ash)
- Kafei Chan (2023) - Carbonation of Slag-Based Geopolymers: Evaluating the Effect on Mechanical Properties and the Potential of Self-Healing.
- Sofia Sakhi (2023) - Interaction of CO_2 with C-A-S-H gel in slag-based geopolymer concrete.

Honors and Awards

- Recipient of prestigious **MEXT (Monbukagakusho) scholarship** from Japanese government for pursuing PhD.
- Received **DAAD-WISE scholarship** by Deutscher Akademischer Austauschdienst (Germany) for research internship at Bundeswehr University Munich, Germany.
- **Ministry of Human Resource Development (M.H.R.D.) Scholarship** by the Government of India, awarded to meritorious research students pursuing M. Tech at different IITs in India.
- Received financial assistance from Design and Innovation Hub (DIH) for project work in sophomore year of bachelors.