# Hao Yin

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## EDUCATION

**Ph.D. in Civil Engineering @ Northwestern University** Supervisor: Gianluca Cusatis 09/2018 – 12/2023

Thesis: *Discrete Modeling of Fracture and Flow in Porous Quasi-brittle Materials by Capturing the Internal Structure*

**M.S. in Civil Engineering @ University of Illinois at Urbana-Champaign (UIUC)** 09/2016 – 05/2018

**B.S. in Civil Engineering @ China Agricultural University (CAU)** 09/2012 – 06/2016

## PROFESSIONAL EXPERIENCE

**Research Associate** Supervisor: Vikram Deshpande 07/2024 – Present

*Department of Engineering, University of Cambridge*

**Postdoctoral Scholar** Supervisor: Gianluca Cusatis 01/2024 – 06/2024

*Department of Civil and Environmental Engineering, Northwestern University*

**Structural Design Intern** 06/2015 – 09/2015

*Beijing Institute of Architectural Design (BIAD), Beijing, China*

## PUBLICATIONS (SELECTED)

1. Amir, B., **Yin, H.,** Wu, R., Meng, Z., Dennis, T., Gandhi, V., Shaikeaa, A.J.D., Liu, B., and Deshpande, V., 2026. **Democratisation of lab-based energy dispersive x-ray diffraction for enhancing measured datasets for mechanical properties**. *In preparation*.
2. **Yin, H.**, Treomner, M., Li, W., Yang, L., Shen, L., Alnaggar, M., Di Luzio, G. and Cusatis, G., 2024. **An interprocess communication-based two-way coupling approach for implicit-explicit multiphysics lattice discrete particle model simulations**. *Engineering Fracture Mechanics, 310*, p.110515.
3. **Yin, H.**, Cibelli, A., Brown, S.A., Yang, L., Shen, L., Alnaggar, M., Cusatis, G., and Di Luzio, G., 2023. **Flow lattice model for the simulation of chemistry dependent transport phenomena in cementitious materials**. *European Journal of Environmental and Civil Engineering, 28*(5), pp.1039-1063.
4. **Yin, H.** and Cusatis, G., 2023. **RingsPy: A Python package for Voronoi mesh generation of cellular solids with radial growth pattern**. *Journal of Open Source Software, 8*(83), p.4945.
5. **Yin, H.**, Lale, E. and Cusatis, G., 2022. **Generalized formulation for the behavior of geometrically curved and twisted three-dimensional Timoshenko beams and its isogeometric analysis implementation**. *Journal of Applied Mechanics, 89*(7), p.071003.
6. **Yin, H.**, Qian, Y., Edwards, J.R. and Zhu, K., 2018. **Investigation of relationship between train speed and bolted rail joint fatigue life using finite element analysis**. *Transportation Research Record, 2672*(10), pp.85-95.

## RESEARCH PROJECTS

**Full-Field Measurement and Material Property Prediction of High-Performance Alloys via X-ray Diffraction** 07/2024 – Present

***DARPA-funded Project, U.S. Department of Defense***

- Developed a novel in-situ, non-destructive full-field stress–strain measurement framework combining Energy Dispersive X-ray Diffraction (EDXRD) and Digital Image Correlation (DIC).
- Proposed a Recurrent Neural Operator (RNO)-based machine learning framework for learning elastoplastic constitutive laws from noisy experimental data under realistic loading conditions.
- Conducted in-situ full-field measurements and material characterization for multiple high-performance alloys including additively manufactured Ti-6Al-4V (Ti64), rolled Ti64, Ti6242, and Al7075.

**Graph-based Learning and design of Advanced Mechanical Metamaterials** 07/2024 – 12/2025

***The UKRI Engineering and Physical Sciences Research Council Project EP/X02394X/1***

- Conducted theoretical and computational analyses of Indentation Size Effect (ISE) of various types of architected solids.
- Conducted in-situ x-ray CT and digital volume correlation (DVC) measurement of indentation tests of architected solids.

**Computational Tools for the Multiscale Simulation of Engineered Wood Products (EWP) Under Dynamic Loading Conditions** 07/2022 – 06/2024

***ERDC-funded Project, U.S. Army Engineer Research and Development Center***

- Formulated a mixed-mode constitutive model for dynamic and strain-rate effects in wood fracture.
- Developed a **dynamic Connector-Beam Lattice (dynaCBL)** model for simulating strain-rate dependent behaviors of Engineered Wood Products (EWP) under impact loading conditions.
- Developed a user-friendly timber structural design software for impact loading scenarios based on FreeCAD.

**Enabling Innovation in Sustainable Structural Building Systems Through Multiscale Modeling and Experimentation of Mass Timber** 07/2018 – 06/2022

***NSF -funded project CMMI-1762757***

- Derived a Generalized Timoshenko beam theory and implemented with Isogeometric Analysis (IGA).
- Developed the **Connector-Beam Lattice (CBL) model** – a discrete modeling framework to investigate the heterogeneous and anisotropic mechanical and fracture behaviors of wood.
- Developed an end-to-end Python-based automated workflow for material modeling, structural analysis, and data post-processing, significantly accelerating timber structure design cycles.

**Study of Modified Rail Joint Bolt-Hole Arrangement Options** 01/2017 – 12/2017

***Jointly funded by New York City Transit & WSP***

- Built an ABAQUS finite element model of the 116RE rail bolted joint system.
- Conducted dynamic fatigue life analysis considering initial defects under varying train speeds.
- Experimentally verified the FE model by conducting in-situ strain measurements of bolt hole areas of rail joints under cyclic loading.

## PATENTS

- **Yin, H.**, **"A Water Damage Test Device for Asphalt Concrete Pavements"**. *CN Patent #2014207575876*, 2015.
- **Yin, H.**, **"A Railway Ballast Cover Plate"**. *CN Patent #2014203065268*, 2014.

## TECHNICAL SKILLS

| | |
|---|---|
| **Math & Computational Tools** | PDE, Finite Element Method, Tensor Analysis, Optimization |
| **Programming Languages** | Python, C++, MATLAB, Fortran, JavaScript, HTML5, Markdown |
| **Engineering & Design Tools** | Abaqus, COMSOL, MOOSE (Open source FEM), Rhino 3D, SolidWorks, FreeCAD |
| **Lab Skills** | MTS testing, strain gauge, DIC, XRD measurement, 3D Printing- FDM & SLA |

## TEACHING EXPERIENCE

**Supervisor** *University of Cambridge* 01/2025 – 04/2025

3D7: Finite Elements Methods

**Teaching Assistant** *Northwestern University* 01/2019 – 04/2022

CIV_ENV 216: Mechanics of Materials

**Teaching Assistant** *Northwestern University* 09/2020 – 12/2022

MECH_ENG 327: Finite Elements Methods in Mechanics