

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*

Committee: Zdeněk Bažant, Gianluca Cusatis, Eric Landis, and John Rudnicki

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

PUBLICATIONS

1. **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.
2. **Yin, H.**, Landis, E.N., and Cusatis, G., 2024. **Connector-beam lattice model for wood: from micromorphology simulation to macroscopic behaviors prediction.** *Journal of the Mechanics and Physics of Solids*, In preparation.
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. Tong, D., Brown, S.A., **Yin, H.**, Corr, D., Landis, E., Di Luzio, G. and Cusatis, G., 2023. **Orthotropic hygroscopic behavior of mass timber: theory, computation, and experimental validation.** *Materials and Structures*, 56(6), p.109.
5. **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.
6. Eliáš, J., **Yin, H.** and Cusatis, G., 2022. **Homogenization of discrete diffusion models by asymptotic expansion.** *International Journal for Numerical and Analytical Methods in Geomechanics*, 46(16), pp.3052-3073.
7. Shen, L., Zhang, H., Di Luzio, G., **Yin, H.**, Yang, L. and Cusatis, G., 2022. **Mesoscopic discrete modeling of multiaxial load-induced thermal strain of concrete at high temperature.** *International Journal of Mechanical Sciences*, 232, p.107613.
8. **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.
9. Wang, C., Peng, H., Bian, L., **Yin, H.**, Sofi, M., Song, Z. and Zhou, Z., 2021. **Performance of alkali-activated cementitious composite mortar used for insulating walls.** *Journal of Building Engineering*, 44, p.102867.

10. Jing, G.Q., Aela, P., Fu, H. and Yin, H., 2019. **Numerical and experimental analysis of single tie push tests on different shapes of concrete sleepers in ballasted tracks.** *Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit*, 233(7), pp.666-677.
11. 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.
12. Shao, S., Jing, G. and Yin, H., 2016. **Ballast flight risk assessment based on reliability theory.** *International Journal of Simulation Systems, Science & Technology*, 17, p.36.
13. Wang, Z., Jing, G., Yu, Q. and Yin, H., 2015. **Analysis of ballast direct shear tests by discrete element method under different normal stress.** *Measurement*, 63, pp.17-24.

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.

RESEARCH PROJECTS

Graph-based Learning and design of Advanced Mechanical Metamaterials 07/2024 – Present

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

- Conducted theoretical and computational analyses of Indentation Size Effect (ISE) of 2D and 3D octet-truss architected solids.

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

A Project Funded by the U.S. Army Engineer Research and Development Center (ERDC)

- 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.

High Performance Fiber Reinforced Concrete Systems using Carbon Fibers at Multiple Length Scales 01/2023 – 09/2023

A Project Funded by ExxonMobil

- Performed mix design and casting of nanomodified concrete specimens with carbon nanotubes (CNT) and turbostratic graphene materials.
- Conducted lab testing for mechanical properties of nanomodified concrete specimens.

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

The National Natural Science Foundation Project CMMI-1762757

- Derived a Generalized Timoshenko beam theory and implemented with Isogeometric analysis (IGA) in finite element software Abaqus.
- Developed **Connector-Beam Lattice (CBL) model** – a multiscale discrete model focusing on the heterogeneous and anisotropic fracture behaviors of wood.
- Developed **RingsPy** – a Python package for generating Voronoi-based cellular wood mesostructure.
- Developed a computational pipeline for the preprocessing-analysis-postprocessing for the CBL model.

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

A Project Funded by the New York City Transit Authority and WSP

- Developed a numerical model of bolted rail joint and performed the dynamic finite element analysis to investigate the mechanical responses of rail-joints under various train speeds using Abaqus.
- Designed and conducted lab measurements of strains at near-bolt hole areas of rail joints under cyclic loads.

PROFESSIONAL EXPERIENCE

Research Associate 07/2024 – Present

Department of Engineering, University of Cambridge

Postdoctoral Scholar 01/2024 – 06/2024

Department of Civil and Environmental Engineering, Northwestern University

Graduate Research Assistant 09/2018 – 12/2023

Department of Civil and Environmental Engineering, Northwestern University

Graduate Teaching Assistant 01/2019 – 04/2022

Northwestern University

- CIV_ENV 216: Mechanics of Materials (19 Winter, 20 Winter, 20 Spring, 21 Spring, 22 Winter)
- MECH_ENG 327: Finite Elements Methods in Mechanics (20 Fall)

Graduate Research Assistant 01/2017 – 12/2017

Rail Transportation and Engineering Center (RailTEC), University of Illinois at Urbana-Champaign

Structural Design Intern 06/2015 – 09/2015

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

RESEARCH TOOLS

Math Tools	ODE, PDE, Optimization, Statistics
Programming	C, C++, Python, MATLAB, Fortran, JavaScript, HTML5, Markdown, L ^A T _E X
Technological Tools	Abaqus, OpenFOAM, PFC (a Discrete Element Modeling Framework), Rhino 3D, Git, Docker
Experimental	MTS testing, additive manufacturing – FDM and SLS

HONORS & AWARDS

Graduate Research Fellowship	<i>Northwestern University</i>	09/2018
Excellent Student Scholarship	<i>China Agricultural University</i>	06/2014
Academic Excellence Scholarship	<i>China Agricultural University</i>	06/2014

PROFESSIONAL SERVICES & ACTIVITIES

Journal Paper Reviewer	2018 – present
<i>Transportation Research Record, Journal of Open Source Software, Mathematics and Mechanics of Solids, Wood Science and Technology, Journal of Building Engineering, Structural Concrete, Measurement, etc.</i>	
Conference Volunteer & Session Moderator	06/2021
<i>The 6th Biot-Bazant Conference on Engineering Mechanics and Physics of Porous Materials and Structures</i>	