Faisal Nissar Malik

Curriculum Vitae

Lehigh University
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Google Scholar
GitHub
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Research Interests

My research focuses on advancing the assessment and design of infrastructure systems subjected to extreme loading through the development of real-time hybrid simulation (RTHS) frameworks that couple physical experiments with high-fidelity computational models. My work emphasizes multi-physics cyber-physical simulations incorporating soil-structure, fluid-structure, and aeroelastic interaction effects using neural-network-based surrogate models and real-time digital twins. The insights gained from these frameworks are applied toward the design and experimental validation of resilient structural systems, including shape-memory-alloy damping systems, nonlinear damping devices, mass timber structures etc.

Research Areas

Multi-physics RTHS Developed the first multi-physics RTHS frameworks integrating neural-network surrogate models of soil-foundation and fluid domains with experimental substructures. Results published in Engineering Structures (2025, 2026) and Earthquake Engineering & Structural Dynamics (2025).

Multi-directional RTAHS Developed multidirectional RTAHS frameworks for evaluating wind-induced response of tall buildings, including real-time aeroelastic load acquisition via scaled façade models in hybrid wind tunnel testing. Published in Engineering Structures (2026).

Real-time Digital Twins Developed real-time digital twin frameworks using online neural-network surrogate models and cyber-physical model updating techniques for RTHS experimental substructures. Published in Earthquake Engineering & Structural Dynamics (2025).

Seismic Resilience of Smart and Sustainable Infrastructure Conducted performance assessment and experimental evaluation of SMA-based damping systems in steel moment-resisting frames and mass timber structures through RTHS. Developed computational and experimental frameworks for seismic resilience and recentering. Two manuscripts currently under review at Earthquake Engineering & Structural Dynamics (2026).

Professional Experience

2022 - present **Graduate Research Assistant**, Department of Civil Engineering, Lehigh University.

2021 - 2022 **Analyst - Risk Management**, American Express.

Education

2022 – 2026 (exp) **Ph.D.**, Structural Engineering, Lehigh University.
Advisor: *Prof. James Ricles*
Tentative Dissertation Title: *AI-Assisted Multi-Physics and Nonlinear Real-Time Hybrid Simulations*

2021 – 2022 **M.S**, Structural Engineering, Indian Institute of Technology Kanpur.
Advisor: *Prof. Chinmoy Kolay*
Thesis Title: *Seismic Response of Tall Buildings with a Single Viscously Damped Outrigger*

2016 - 2020 **B.S.**, Civil Engineering, Indian Institute of Technology, Kanpur.

Curriculum Vitae Statistics

Publications 8 peer-reviewed journal articles (6 published, 2 under review), 7 conference proceedings, >60 citations, h-index: 4, i10-index: 2 (Google Scholar, May 2026)

Journal Articles

Under review

[1] **Faisal Malik**, James M. Ricles, Richard Sause, Liang Cao, and Alia Amer. Seismic performance assessment of mass timber buildings with clt rocking walls. *Earthquake Engineering & Structural Dynamics*, 2026. Under review, Manuscript ID: 8426032, submitted May 11, 2026

[2] **Faisal Malik**, Liang Cao, James M. Ricles, Fei Shi, Chinmoy Kolay, and Osman E. Ozbulut. Seismic resilience of reduced-strength steel mrfs with sma-based superelastic friction dampers: An experimental investigation. *Earthquake Engineering & Structural Dynamics*, 2026. Under review, Manuscript ID: 1093373, submitted April 12, 2026

Published

[1] **Faisal Malik**, Haitham A. Ibrahim, Liang Cao, James Ricles, Amal Elawady, and Arindam Gan Chowdhury. Real-time multi-directional aeroelastic hybrid simulation for tall building response under wind loading. *Engineering Structures*, 353:122185, 2026. doi:10.1016/j.engstruct.2026.122185

[2] **Faisal Malik**, Dimitrios Kalliontzis, James Ricles, and Liang Cao. Real-time hybrid simulation of fluid–structure interaction systems using neural network models and the ale-ssm framework. *Engineering Structures*, 351:122009, 2026. doi:10.1016/j.engstruct.2025.122009

[3] **Faisal Malik**, Liang Cao, James Ricles, and Austin Downey. Online cyber-physical neural network model for real-time hybrid simulation. *Earthquake Engineering & Structural Dynamics*, 54(13):3457–3474, 2025. doi:10.1002/eqe.70036

[4] **Faisal Malik**, Davide Noè Gorini, James Ricles, and Maryam Rahnemoonfar. Multi-physics framework for seismic real-time hybrid simulation of soil–foundation–structural systems. *Engineering Structures*, 334:120247, 2025. doi:10.1016/j.engstruct.2025.120247

[5] Safwan Al-Subaihawi, James Ricles, Spencer Quiel, Thomas Marullo, and **Faisal Malik**. Real-time hybrid simulation of structural systems with soil-foundation interaction effects using neural networks. *Earthquake Engineering & Structural Dynamics*, 2024. doi:10.1002/eqe.4236

[6] **Faisal Malik** and Chinmoy Kolay. Optimal parameters for tall buildings with a single viscously damped outrigger considering earthquake and wind loads. *The Structural Design of Tall and Special Buildings*, 32(7):e2003, 2023. doi:10.1002/tal.2003

Conference Proceedings

[1] **Faisal Malik**, James Ricles, Geoffrey W. Rodgers, and Claudia Reis. Innovative quadrant-specific nonlinear viscous dampers for seismic high-performance design and retrofit of rc structures. In *Proceedings of the 7th fib Congress*, Lisbon, Portugal, 2026. International Federation for Structural Concrete (fib). Accepted

[2] **Faisal Malik**, Davide Noe Gorini, James Ricles, and Maryam Rahnemoonfar. Surrogate modeling of soil-structure interaction using neural networks for real-time hybrid simulation. In *Computational Dynamic Soil-Structure Interaction – Proceedings of the 2026 International Conference CompDSSI*, Lecture Notes in Civil Engineering. Springer Nature Switzerland AG, 2026. Accepted

[3] **Faisal Malik**, Liang Cao, James Ricles, and Austin Downey. Physics-based online cyber-physical neural network models for real-time hybrid simulation. In *Proceedings of the International Modal Analysis Conference (IMAC)*. Society for Experimental Mechanics (SEM), 2026

[4] James M. Ricles, Davide N. Gorini, **Faisal Malik**, Safwan Al-Subaihawi, Qaisar Abu Kassab, Mohammad Suleiman, and Richard Sause. Modeling soil-foundation response of offshore wind turbines under realistic dynamic loading using the thermodynamic inertial macroelement. In *Computational Dynamic Soil-Structure Interaction (CompDSSI) International Workshop*, Assisi, Italy, September 2024. September 11–13, 2024

[5] **Faisal Malik**, Davide N. Gorini, James Ricles, and Thomas Marullo. Neural network-aided multi-directional real-time hybrid simulations of soil-structure systems: The case of a multi-story mrf-dbf frame. In *Computational Dynamic Soil-Structure Interaction (CompDSSI) International Workshop*, Assisi, Italy, September 2024. September 11–13, 2024

[6] **Faisal Malik**, James Ricles, and Masoud Yari. Physics informed neural network architecture for dynamic response analysis of nonlinear structural systems. In *Proceedings of the 18th World Conference on Earthquake Engineering*, Milan, Italy, July 2024. International Association for Earthquake Engineering

[7] Liang Cao, **Faisal Malik**, Safwan Al-Subaihawi, Wendy Miao, James Ricles, T. Marullo, Chinmoy Kolay, Austin Downey, and Simon Laflamme. Real-time hybrid simulation (rths) of a 2-story building equipped with novel base isolation systems. In *Proceedings of the 18th World Conference on Earthquake Engineering*, Milan, Italy, July 2024. WCEE2024

[8] E. Villalobos Vega, P. S. Harvey, James Ricles, Liang Cao, **Faisal Malik**, and T. Marullo. Multi-directional shake table real-time hybrid simulations of floor isolation systems in buildings. In *Proceedings of the 18th World Conference on Earthquake Engineering*, Milan, Italy, July 2024. 18th WCEE

[9] **Faisal Malik** and K. Chinmoy. Optimum parameters for seismically excited tall buildings with a single viscously damped outrigger. In *Proceedings of the 12th National Conference on Earthquake Engineering*, Salt Lake City, Utah, USA, 2022. Earthquake Engineering Research Institute (EERI)

Invited Talks

2025 **Short Course**: Ricles, J., **Malik, F.N.**, and Marullo, T. Hybrid Simulation 101: Short Course on Theory, Implementation, and Application of Real-Time Hybrid Simulation. *NHERI Lehigh Workshop*, 2025.

2024 **Invited Speaker**: **Malik, F.N.** Artificial intelligence for assessing soil-structure interaction problems. *International Advanced School on Soil-Structure Interaction in OpenSees (SSI-OS)*, 2024.

Selected Presentations

[1] **Malik, F.N.** Real-Time Hybrid Simulation of Fluid-Structure Interaction Systems Using Neural Network Models and the ALE-SSM Framework. *NHERI Computational Symposium*, 2026.

[2] **Malik, F.N.** Real-Time Seismic Multi-Physics Cyber-Physical Simulations of Soil-Foundation-Structure Interaction Systems Using Neural Network Models. *Engineering Mechanics Institute (EMI) Conference*, 2025.

[3] **Malik, F.N.** RTHS of a Three-Story MRF-DBF Frame with Soil-Structure Interaction Using Neural Networks. *NHERI Computational Symposium*, 2025.

[4] **Malik, F.N.** Neural Network-Aided Multi-Physics Real-Time Cyber-Physical Simulations of Soil-Foundation-Structure Systems. *CompDSSI*, 2024.

[5] **Malik, F.N.** Multi-Directional RTHS of a Three-Story MRF-DBF Frame with Soil-Structure Interaction Using Neural Networks. *STESSA*, 2024.

[6] **Malik, F.N.** Physics-Informed Neural Network Architecture for Dynamic Response Analysis of Nonlinear Structural Systems. *World Conference on Earthquake Engineering (WCEE)*, 2024.

[7] **Malik, F.N.** 3D Real-Time Hybrid Simulation of Systems with Physics-Based Machine Learning Model Updating. *NHERI Computational Symposium*, 2022.

Abstracts and Extended Abstracts

[1] **Malik, F.N.**, Gorini, D.N., Ricles, J., Al-Subaihawi, S., and Marullo, T. Multi-Directional RTHS of a Three-Story MRF-DBF Frame with Soil-Structure Interaction Using Neural Networks. *Engineering Mechanics Institute Conference*, Chicago, IL, 2024.

[2] Cao, L., **Malik, F.N.**, Ricles, J., Marullo, T., Kolay, C., Downey, A., and Laflamme, S. Real-Time Hybrid Simulation (RTHS) of a Two-Story Reinforced Concrete Building Equipped with a Novel Self-Centering Base Isolation System. *Engineering Mechanics Institute Conference*, Chicago, IL, 2024.

[3] **Malik, F.N.**, Ricles, J., Cao, L., Downey, A., and Laflamme, S. Neural Network-Aided Real-Time Model Updating of Experimental Substructures in Real-Time Hybrid Simulations. *NHERI Computational Symposium*, Los Angeles, CA, 2025.

[4] **Malik, F.N.**, Ricles, J., Cao, L., Downey, A., and Laflamme, S. Neural Network-Based Real-Time Digital Twin Models of Experimental Substructures for Real-Time Hybrid Simulations. *Engineering Mechanics Institute Conference*, Anaheim, CA, 2025.

[5] Ricles, J., **Malik, F.N.**, Abu-Kassab, Q., Kalliontzis, D., Reis, C., Suleiman, M., and Gorini, D.N. Cyber-Physical Simulation of Coastal Infrastructure Subject to Extreme Loading Conditions. *39th International Conference on Coastal Engineering (ICCE)*, 2026.

[6] **Malik, F.N.**, Gorini, D.N., Ricles, J., and Rahnemoonfar, M. Soil-Foundation-Structure Interaction Effects on the Seismic Efficacy of Nonlinear Viscous Dampers in Steel Frame Buildings. *ASCE Structures Congress*, 2027.

Technical Reports

[1] **Malik, F.N.**, Marullo, T., and Ricles, J. Integration of Python-Based Metamodels within Simulink to Facilitate Real-Time Hybrid Simulation Execution. *ATLSS Engineering Research Center, Lehigh University*, ATLSS Report No. 25-01, Bethlehem, PA, 2025.

[2] Ricles, J., **Malik, F.N.**, and Marullo, T. Real-Time Neural Network-Based Digital Twins with Online Model Updating for Performing Real-Time Hybrid Simulations. *ATLSS Engineering Research Center, Lehigh University*, ATLSS Report No. 26-01, Bethlehem, PA, 2026.

Teaching Experience

2021 **Teaching Assistant** for Mechanics of Solids during Fall 2020 and Spring 2021 at IIT Kanpur

2023 **Teaching Assistant** for Soil Mechanics during Spring 2023 at Lehigh University

2024 **Teaching Assistant** for Structural Analysis II during Spring 2024 at Lehigh University

2024 **Teaching Assistant** for Structural Analysis I during Fall 2024 at Lehigh University

2025 **Teaching Assistant** for Design Project during Spring 2025 at Lehigh University

Mentorship Experiences at Lehigh University

Graduate students

[1] **Osama Ahmed Nakhleh** Ph.D. Civil Engineering, "Real-time hybrid simulations of floating wind turbines."

Undergraduate students

[1] **Rachid Pierre Louis Seraphin**, "Determining the shear and flexural section stiffness of a CLT shear wall.", 2025

[2] **Alyssa Griffin**, "Analysis of reinforced concrete frames with self-centering dampers.", 2024.

[3] **Hansui Wang**, "Analysis of reinforced concrete frames with self-centering base isolation.", 2024.

[4] **Christy Joy Tupas**, "Multi-Physics Cyber-Physical Simulations: Challenges in Fluid-Structure Interaction", 2024, Natural Hazards Engineering Research Infrastructure (NHERI) Research Experiences for Undergraduates (REU).

Fellowships and Awards

[1] **1st position**, INSDAG National Civil Awards, 2019

[2] **Dean's Fellowship**, Lehigh University, 2022

[3] **Gibson Fellowship**, Lehigh Univeristy, Fall 2023 and Spring 2024

[4] **Yen Fellowship**, Lehigh University, Spring 2025

[5] **SEI-LV Travel Scholarship Award**, Lehigh Valley CEI Chapter, 2025

Academic Service - Peer Reviewer

Journal/Venue	**Publisher**
Journal of Building Engineering	Elsevier
Journal of Computing in Civil Engineering	ASCE
Advanced Engineering Informatics	Elsevier
Structural Control and Health Monitoring	Wiley
PBD-V (International Conference), Chile	ISSMGE

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