

Minhyeok Ko

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PROFESSIONAL APPOINTMENT

The University of Texas at Tyler <i>Assistant Professor of Civil Engineering (Tenure-Track)</i>	Aug. 2025 – Present <i>Tyler, TX</i>
The Ohio State University <i>Postdoctoral Research Associate and Instructor</i>	Jan. 2024 – Aug. 2025 <i>Columbus, OH</i>
The Pennsylvania State University <i>Graduate Research/Teaching Assistant</i>	Aug. 2016 – Dec. 2023 <i>University Park, PA</i>

RESEARCH INTERESTS

- **Digital Twin Technology:** Physics-informed digital twins for civil infrastructure, with emphasis on wind turbines and renewable energy systems
- **Structural Health Monitoring:** Real-time state estimation, damage detection, and resilience-based decision making
- **Uncertainty Quantification:** Probabilistic risk assessment, fragility analysis, and reliability methods for complex structural systems
- **Data Assimilation:** Bayesian filtering, Kalman filters, and sequential Monte Carlo approaches for dynamic systems
- **Machine Learning Applications:** Deep learning, reinforcement learning, and physics-informed neural networks for predictive modeling in structural engineering

EDUCATION

The Pennsylvania State University <i>Ph.D. in Civil Engineering (Structural Engineering)</i>	Aug. 2016 – Dec. 2023 <i>University Park, PA</i>
Northwestern University <i>M.S. in Civil Engineering (Structural Engineering)</i>	Sep. 2015 – Aug. 2016 <i>Evanston, IL</i>
Chung-Ang University <i>M.E. in Structural Engineering in Architecture</i>	Mar. 2012 – Feb. 2014 <i>Seoul, South Korea</i>
Chung-Ang University <i>B.S. in Architectural Engineering (Structure)</i>	Mar. 2006 – Feb. 2012 <i>Seoul, South Korea</i>

RESEARCH EXPERIENCE

The Ohio State University <i>Postdoctoral Research Associate (Advisor: Dr. Abdollah Shafieezadeh)</i>	Jan. 2024 – Aug. 2025 <i>Columbus, OH</i>
• Developing model-based Deep Learning (DL) methods for accurate state estimation and uncertainty quantification in infrastructure systems, addressing challenges in resilience and sustainability for critical civil infrastructure. • Advancing Digital Twin (DT) frameworks for wind turbine monitoring by integrating data-driven machine learning approaches with physics-informed Bayesian filtering techniques, enabling real-time state estimation and predictive maintenance under complex operational conditions.	

- Developing fragility models for reinforced concrete panels subjected to projectile impacts applying enhanced adaptive reliability analysis methods and surrogate modeling.
- Mentoring undergraduate students in a Research Experiences for Undergraduates (REU) program sponsored by The National Science Foundation (NSF)

The Pennsylvania State University

Aug. 2018 – Dec. 2023

Graduate Student Researcher (Advisor: Dr. Kostas Papakonstantinou)

University Park, PA

- Proposed novel probabilistic modeling methodologies addressing uncertainty quantification for stochastic processes, particularly valuable in the context of large-scale nonlinear dynamic systems.
- Created highly efficient numerical techniques for uncertainty propagation and Bayesian inference, utilizing advanced algorithms such as the Kalman Filter.
- Employed a fully parametrized nonlinear model enabling the simulation of the intricate dynamic behavior of large-dimensional structures within a computationally efficient framework.
- Conducted large-scale simulations for real-time probabilistic damage assessment of structures exposed to seismic events or other catastrophic incidents.

The Pennsylvania State University

Aug. 2016 – Aug. 2018

Research Lab Assistant (Advisor: Dr. Ali Memari)

University Park, PA

- Developed the structural engineering consideration in additive manufacturing using cementitious material working with ten (10) research groups from five (5) different departments.
- Conducted large-scale testing for 3D-printed concrete dome structures.
- Designed the Martian cement for NASA challenges of 3D-printed habitat on Mars.

Northwestern University

Sep. 2015 – Aug. 2016

Graduate Student Researcher (Advisor: Dr. Gianluca Cusatis)

Evanston, IL

- Researched effects of creep and shrinkage on column shortening in tall buildings considering various ambient conditions.
- Performed finite element analysis utilizing the Hygro-Thermo-Chemical model for concrete hydration and the Solidification-Microprestress-Micropore models for creep and shrinkage.

Chung-Ang University

Mar. 2012 – Feb. 2014

Graduate Research Assistant (Advisor: Dr. Chadon Lee)

Seoul, South Korea

- Developed crack-reducing technology by identifying the characteristics of long-term behavior of prestressed concrete structure.
- Conduct full-scale experiments for prestressed concrete structures.
- Performed experiments to develop innovative stirrups for shear strength improvement of FRP-reinforced concrete beam.

TEACHING EXPERIENCE

The University of Texas at Tyler

Aug. 2025 – Present

Assistant Professor

Tyler, TX

- CENG3325: Structural Analysis (SP 2026 – FA 2026)
- CENG3306: Mechanics of Materials (FA 2025 – FA 2026)
- CENG3334: Civil Engineering Materials, Codes, and Specifications (FA 2025 – FA 2026)

The Ohio State University

Aug. 2024 – Aug. 2025

Instructor

Columbus, OH

- Structural Engineering Principle (FA 2024 – SP 2025)

The Pennsylvania State University

Jan. 2021 – Dec. 2023

Graduate Teaching Assistant

University Park, PA

- Advanced Structural Design (Capstone Design) (SP 2021, SP 2022, SP 2023)
- Professionalism, Engineering Economics and Construction Project Delivery (FA 2021, FA 2022 – FA 2023)
- Taught advanced structural design concepts to undergraduate students, including load calculation (ASCE 7), reinforced concrete design (ACI 318), steel design (AISC Manual), general building standard (IBC) and SAP2000 modeling.
- Mentored 60+ undergraduate students with an emphasis of structure in Civil Engineering.

ACADEMIC PROJECTS

- Real-time Aircraft Trajectory Estimation Using Bayesian Filter** 2019
- Performed model-data fusion for real-time air traffic control using noisy radar measurement data.
 - Estimated the trajectory of aircraft for air-traffic control in real-time using Bayesian inference.
 - Investigated the performance of different model-based online state estimation algorithms, by implementing Extended Kalman filter (EKF), Unscented Kalman filter (UKF), Sequential Monte Carlo scheme, and higher order Bayesian inferencing techniques.
- Seismic Assessment of a 3-Story Building in Santa Rosa, CA** 2017
- Conducted a comprehensive seismic performance evaluation of a 3-story building, determining interstory drift ratios under various earthquake scenarios.
 - Analyzed the building's steel moment frame to understand its behavior and resilience under seismic loads ensuring structural safety and integrity
 - Assessed potential drift limit exceedances, providing crucial insights for potential retrofitting needs.
- Seismic Assessment and Retrofitting of a Water Tower in Southern California** 2017
- Evaluated the structural integrity of a 33-foot tall water tower, ensuring compliance with ASCE 7 guidelines and assessing the tower's response to specific ground motions.
 - Proposed retrofitting methodologies to enhance the tower's resilience against seismic activities, safeguarding critical connections and ensuring foundation capacity.
- Earthquake Resistant Design of a 9-Story Wall Office Building** 2016
- Designed a 9-story office building successfully with a focus on earthquake resistance, incorporating advanced seismic force load determination and ensuring structural integrity.
 - Conducted a comprehensive modal response spectrum analysis, ensuring the building's resilience against potential seismic activities and optimizing its structural elements for maximum safety.
 - Performed detailed hand calculations for the design of structural elements, including beams, columns, and shear walls.

SKILLS

Programming & Software: Python, R, MATLAB, Maple, Abaqus, SAP2000, ETABS, AutoCAD

Statistics: Structural Reliability, Risk Assessment, Fragility Analysis, Stochastic Process

Data Assimilation: Kalman Filters, Bayesian Filter, Particle Filter, Higher Order Bayesian Filter

Machine Learning: Deep Learning, Reinforcement Learning, Bayesian Neural Network, Convolutional Neural Network, Physics-informed Neural Network

Design Code: ACI 318, AISC 360, ASCE 7, IBC

SERVICE

University Service

Judge Oct. 2025

4th UT Tyler COE Ratliff Relay

Faculty Advisor Sep. 2025 – Present

ASCE Student Chapter Concrete Canoe

Non-university Service

Reviewer Sep. 2023 – Present

Reliability Engineering & System Safety

Reviewer Sep. 2023 – Present

Probabilistic Engineering Mechanics

Reviewer Sep. 2024 – Present

IEEE Transactions on Signal Processing

Reviewer Sep. 2025 – Present

Structural Health Monitoring

OUTREACH ACTIVITIES

- K–12 STEM Outreach – Central Ohio Miniature Bridge Building Competition** **2024**
Event Proctor and Team Liaison *Columbus, OH*
- Supervised student participants during bridge building to ensure safety and fair competition.
 - Served as liaison between student teams and judging panel to streamline communication and logistics.

HONORS & AWARDS

- 2nd Place, NASA’s 3D-Printed Habitat Challenge, Phase 2: Level 3** **Aug. 2017**
The National Aeronautics and Space Administration (NASA)
- 1st Place, 47th Chung-Ang Architecture Graduate Competition – Structure** **Dec. 2011**
Chung-Ang University, School of Architecture & Building Science
- Special Prize, 4th Structural Design Competition** **Dec. 2011**
The Korean Structural Engineers Association
- Highest Academic Honor** **2010, 2012 – 2013**
Chung-Ang University
- High Academic Honor** **2006 – 2007**
Chung-Ang University

PUBLICATIONS

Peer-reviewed Journal Articles

Published

1. **Ko, M.**, & Shafieezadeh, A. (2025). Robust wind turbine monitoring for digital twin integration: A physics-informed covariance-preserving deep learning approach. *Renewable Energy*.
<https://doi.org/10.1016/j.renene.2025.123176>
2. **Ko, M.**, & Papakonstantinou, K. (2025). The quadratic point estimate method for probabilistic moments computation. *Probabilistic Engineering Mechanics*.
<https://doi.org/10.1016/j.probengmech.2024.103705>
3. **Ko, M.**, & Shafieezadeh, A. (2024). Cholesky–KalmanNet: Deep learning–based Kalman filters estimating state and error covariance. *IEEE Signal Processing Letters*.
<https://ieeexplore.ieee.org/document/10804573>
4. Lee, S., Kim, Y., **Ko, M.**, & Lee, C. (2019). Assessment of thermal prestress loss with re-tensioning tests. *ACI Structural Journal*, 116(6).
Link
5. Lee, C., **Ko, M.**, & Lee, Y. (2014). Bend strength of complete closed-type carbon fiber–reinforced polymer stirrups with rectangular section. *Journal of Composites for Construction*, 18(1), 04013022.
[https://doi.org/10.1061/\(ASCE\)CC.1943-5614.0000428](https://doi.org/10.1061/(ASCE)CC.1943-5614.0000428)

Submitted

6. **Ko, M.**, & Papakonstantinou, K. (submitted, 2026). Quadratic point estimate method for uncertainty quantification under copula-based input dependencies. *Journal of Computational Physics*.
7. **Ko, M.**, & Shafieezadeh, A. (submitted, 2026). Unscented KalmanNet: Structure-Preserving Deep Learning with Calibrated Posterior Uncertainty under Incomplete Physics and Unknown Noise. *Information Fusion*.

In Preparation

8. **Ko, M.**, & Shafieezadeh, A. (in prep). Augmented-State Unscented KalmanNet: Joint State and Parameter Estimation for Nonlinear Dynamical Systems

9. **Ko, M.**, & Papakonstantinou, K. (in prep). A review and new perspectives on probabilistic point-estimate methods.
10. **Ko, M.**, & Papakonstantinou, K. (in prep). Probability density evaluation through the quadratic point estimate method for static, dynamic and multi-output cases.

Conference Proceedings

1. **Ko, M.**, & Shafieezadeh, A. (2025). Deep learning-based digital twin models for real-time monitoring of renewable energy systems. *Career Speaker Series and Research Poster Session*, Bryd Polar and Climate Research Center, The Ohio State University, Columbus, OH, USA.
2. **Ko, M.**, & Shafieezadeh, A. (2025). Unscented KalmanNet: physics-based, data-driven nonlinear state estimation for structural health monitoring and system identification. *14th International Conference on Structural Safety and Reliability (ICOSSAR'25)*, University of Southern California, Los Angeles, CA, USA.
3. **Ko, M.**, & Shafieezadeh, A. (2025). Deep learning-based digital twin models for real-time monitoring of onshore wind turbines. *NHERI Computational Symposium*, University of California, Los Angeles, CA, USA.
4. **Ko, M.**, & Papakonstantinou, K. (2023). Copula-based quadratic point estimate method for probabilistic moments evaluation. *14th International Conference on Applications of Statistics and Probability in Civil Engineering (ICASP14)*, Trinity College Dublin, Ireland.
5. **Ko, M.**, & Papakonstantinou, K. (2023). Copula-based quadratic point estimate method under incomplete probability information. *Engineering Mechanics Institute Conference 2023 (EMI 2023)*, Georgia Institute of Technology, Atlanta, GA, USA.
6. **Ko, M.**, & Papakonstantinou, K. (2022). An efficient and accurate point estimate method for probabilistic moments evaluation. *Engineering Mechanics Institute Conference 2022 (EMI 2022)*, Johns Hopkins University, Baltimore, MD, USA.
7. **Ko, M.**, Memari, A. M., Duarte, J. P., Nazarian, S., Ashrafi, N., Craveiro, F., & Bilen, S. (2018). Preliminary structural testing of a 3D-printed small concrete beam and finite element modeling of a dome structure. *The 42nd IAHS World Congress – The Housing for the Dignity of Mankind*, Naples, Italy.
8. **Ko, M.**, & Lee, C. (2014). Bend strength of complete closed-type carbon fiber reinforced polymer stirrups with rectangular section. *2013 Spring Conference – Korea Institute for Structural Maintenance Inspection (KSMI)*, Busan, South Korea.
9. **Ko, M.**, & Lee, C. (2013). Estimation of prestress loss due to steam curing. *2013 Spring Conference – Korea Institute for Structural Maintenance Inspection (KSMI)*, Busan, South Korea.
10. **Ko, M.**, & Lee, C. (2012). Theoretical prediction of prestress loss during steam curing process. *2012 Fall Conference – Korea Concrete Institute (KCI)*, Gangwon, South Korea.