

# Pengfei Ma

Postdoctoral Fellow, Missouri University of Science and Technology

Email: [pm7m8@mst.edu](mailto:pm7m8@mst.edu) Phone: +1 (573) 466-1403 Web: [Google Scholar](https://scholar.google.com/citations?user=pm7m8)

## RESEARCH INTERESTS

---

Tackling real-world infrastructure resilience and sustainability challenges by developing novel cement and smart concrete for renovation and construction, investigating structural degradations and perform reliability and risk assessment, and deploying multimodal sensors in UAV for defect detection and health monitoring for bridges.

## EMPLOYMENT & APPOINTMENT

---

**Missouri University of Science and Technology**, Rolla, MO

**Postdoctoral Fellow**, Laboratory of Future Cements and Carbon-negative Initiatives      Sept. 2024 – present  
Host: Dr. Hongyan Ma

**Lab Manager**, System and Process Assessment Research Laboratory      Jun. 2020 – Aug. 2024  
Host: Dr. Genda Chen

**Course Instructor** for CIV/ARCH ENG 3201: *Structural Analysis I*, Department of Civil, Architectural, and Environmental Engineering      Aug. 2023 - May 2024

## EDUCATION

---

**Doctor of Philosophy in Civil Engineering**      Aug. 2019 – Aug. 2024  
Missouri University of Science and Technology, Rolla, MO

**Dissertation title:** *Application of Multimodal Sensors with Visual, Thermal, and Hyperspectral Imaging in Infrastructure Inspection.*

Advisor: Dr. Genda Chen

**M.S. in Structural Engineering (Bridging Engineering)**      Sept. 2016 - May 2019  
Hunan University, Changsha, Hunan  
Advisors: Drs. Xudong Shao and Hua Zhao

**B.S. in Civil Engineering**      Sept. 2012 – Jun. 2016  
Hunan University, Changsha, Hunan

## PUBLICATIONS

---

### Journal Papers

1. Zhuo, Y., **Ma, P.**, Jiao, P. and Yuan, X., 2024. Application of Long-Period Fiber Grating Sensors in Structural Health Monitoring: A Review. *CivilEng*, 5(3), pp.559-575.
2. **Ma, P.**, Mondal, T.G., Shi, Z., Afsharmovahed, M.H., Romans, K., Li, L., Zhuo, Y. and Chen, G., 2024. Early Detection of Pipeline Natural Gas Leakage from Hyperspectral Imaging by Vegetation Indicators and **Deep Neural Networks**. *Environmental Science & Technology*.
3. **Ma, P.**, Liao, W., Zhuo, Y., Zhu, Y., Ma, H., Chen, G., 2024. Characterization of Alkali-Silica Reaction (ASR) Products and C-S-H Using SWIR Spectroscopy for Nondestructive Detection of ASR. *Construction and Building Materials*, 416, 135207.
4. Zhuo, Y., **Ma, P.**, Guo, C. and Chen, G., 2024. Probability of Detection for Corrosion-Induced Steel Mass Loss Using Fe-C Coated LPFG Sensors. *Structural Health Monitoring*, p.14759217241227229.
5. **Ma, P.**, Zhuo, Y., Chen, G. and Burken, J.G., 2024. Natural Gas Induced Vegetation Stress Identification and Discrimination from Hyperspectral Imaging for Pipeline Leakage Detection. *Remote Sensing*, 16(6), p.1029.

6. **Ma, P.**, Li, J., Bai, J., Zhuo, Y., Chi, L., Zhu, Y., Shi, Z., Ma, H. and Chen, G., 2023. Effect of Type and Quantity of Inherent Alkali Cations on Alkali-Silica Reaction. *Cement and Concrete Research*, 173, p.107293.
7. Zhang, Y., Zhu, Y., **Ma, P.**, He, S. and Shao, X., 2024. Effect of Ages and Season Temperatures on Bi-Surface Shear Behavior of HESUHPC-NSC Composite. *Advances in concrete construction*, 15(6), pp.359-376
8. **Ma, P.**, Li, J., Zhuo, Y., Jiao, P. and Chen, G., 2023. Coating Condition Detection and Assessment on the Steel Girder of a Bridge through Hyperspectral Imaging. *Coatings*, 13(6), p.1008.
9. **Ma, P.**, Fan, L. and Chen, G., 2023. Hyperspectral Imaging for Determination of Steel Rebar Corrosion and  $\text{Cl}^-$  Concentration. *Construction and Building Materials*, 368, p.130506.

### Manuscripts in Preparation

1. **Ma, P.**, Zhuo, Y., Zhu, Y., Ma, H., Chen, G.. Alkali-Silica Reaction Expansion: The Role of Paste Degradation in Presence of Alkalies, *Cement and Concrete Research*. (**Under Review**)
2. **Ma, P.**, Fan, L., Y., Zhuo, Y., Ma, H., Chen, G.. Inhibition of the Chloride Penetration by Electrical Treatment on Mortar to Reduce Corrosion on Rebar.
3. Cai K., **Ma, P.**, Hafiz R., Ma H., Compressive Strength Prediction of Freeze-Thaw Damaged Concrete Using Hyperspectral Imaging and Data-Driven Methods.
4. Shi, Z., **Ma, P.**, Ghosh, T., Alomari, I., Chen, G., 2024. A Comprehensive Bridge Health Monitoring by an Unmanned Aerial Vehicle (UAV) with the Integration of Hyperspectral, Thermal, And Lidar Sensors.
5. Afsharmovahed, M., **Ma, P.**, Alomari, I., Shi, Z., Woubishet, T., Runji, J., Nguyen, S., Chen, G., 2024. A Novel Deep Learning Architecture to Detect and Assess the Structural Defects in Bridges, *Automation in Construction*.
6. Zhuo, Y., **Ma, P.**, Chen, G.. Comparison of Three Types of Long-period Fiber Grating Sensors (LPFG) in Corrosion Monitoring.

### CONFERENCE PROCEEDINGS

1. **Ma, P.**, Zhuo, Y., Chen, G., Effect of Alkali Cations in Different Environments on Alkali-Silica Reaction (ASR) Expansion, 14th Advances in Cement-Based Materials 2024, Rolla, MO, 19 - 21 June 2024.
2. Cai K., **Ma, P.**, Hafiz R., Ma H., Compressive Strength Prediction of freeze-Thaw Damaged Concrete Using Hyperspectral Imaging and Data-Driven Methods, 14th Advances in Cement-Based Materials 2024, Rolla, MO, 19 - 21 June 2024.
3. **Ma, P.**, Chen, G., Early Detection of Underground Natural Gas Leak from Hyperspectral Imaging by Vegetation Indicators and Deep Neural Networks (DNN), Geo-Resolution 2023, St. Louis, MO, 26 - 28 September 2023.
4. **Ma, P.**, Zhuo, Y., Chen, G., Condition Evaluation of Steel Girder Coating from Hyperspectral Imaging, SPIE. Smart Structure, Nondestructive Evaluation 2023, Long Beach, CA, 24 - 26 March 2023.
5. **Ma, P.**, Shi, Z., Chen, G., Pipeline Leakage Detection by Mapping Vegetation Stress Indices from Hyperspectral Imaging, Geo-Resolution 2022, St. Louis, MO, 26 - 28 September 2022.
6. **Ma, P.**, Fan, L., Chen, G., Poster presentation at US DOT conference, PHMSA Pipeline Safety Research and Development Forum, Arlington, VA, 19 - 20 February 2020.

### HONORS & AWARDS

- |   |            |
|---|------------|
| 1. Dean's Distinguished Ph.D. Scholar Award, Missouri University of Science and Technology  | 2024       |
| 2. 2 <sup>nd</sup> (out of 42) in the poster competition of the National Geospatial Science and Technology Conference, Saint Louis University | 2022       |
| 3. First-Class Scholarship, Hunan University  | 2017, 2018 |
| 4. Outstanding Award in Structure Analysis Competition  | 2015       |
| 5. Second-Class Scholarship, Hunan University   | 2014, 2015 |
| 6. Second Place in FLTRP Cup National English Writing Contest   | 2013       |
| 7. BOSH Scholarship, (5/512), Hunan University  | 2012       |

## RESEARCH EXPERIENCE

---

**Postdoctoral Fellow**, Missouri University of Science and Technology Mar. 2024 - present  
Advisor: Dr. Hongyan Ma, Laboratory of Future Cements and Carbon-negative Initiatives (FuCCI)

- **Advanced Materials for Sustainable Structures**

- R&D of low-carbon cement alternatives.
- Carbon capture and storage in cementitious materials.
- Fiber-reinforced concrete and 3D-printing with concrete for structure construction, repair and retrofit.

**Graduate Research Assistant**, Missouri University of Science and Technology, Aug. 2019 – Aug. 2024  
Advisor: Dr. Genda Chen, Center for Intelligent Infrastructure (CII)

- **Deploying Multimodal Sensors in the Early Detection of Structural Durability Problems**

- Established a prediction model between hyperspectral imaging spectroscopy and chloride profile in depth to predict the chloride corrosion occurrence on rebar.
- Employed a long-period fiber grating sensors (LPFG) to monitor the rebar corrosion and quantitatively assessed the corrosion severity.
- Detected ASR before deleterious expansion using spectroscopic features from hyperspectral imaging.
- Deployed multimodal sensors in coating degradations and defects detection on steel girders of bridges.

- **Investigating the Concrete Durability Degradations, ASR and Chloride Corrosion**

- Revealed the underlying mechanisms behind alkali-silica reaction (ASR).
- Identified different Na and K roles in ASR and disclosed the mechanism behind the difference.
- Examined the factors that accelerate rebar corrosion in concrete and proposed a novel electrical treatment method to inhibit the chloride penetration.

- **Deploying Sensor Technologies along with Machine Learning for Bridge Inspection**

- Integrated hyperspectral, thermal cameras and LiDAR in drone platforms for bridge inspection.
- 3D modeling of the bridges and feature selection for defects.
- Proposed a deep neural network (DNN) architecture for bridge defects detection.

- **Applying Remote Sensing Technologies in Carbon Gas Leak Detection**

- Implemented the early detection of greenhouse gas (GHG) by remote sensing technologies.
- Integrated hyperspectral and thermal cameras in the early detection of GHG leaks.
- Proposed a novel detection strategy along with deep neural networks (DNN).

**Research Assistant**, Hunan University, Changsha, CHINA Sept. 2016 - May 2019

- **Health Monitoring of Orthotropic Steel Bridge Decks with Bridge Weigh-in-motion (BWIM) System**

- Developed algorithms to identify the axle weight of vehicles in motion on steel orthotropic decks.
- Monitored the health condition of orthotropic bridge decks with the BWIM data.
- Assessed the fatigue performance of the welding connections between U-ribs with the steel deck.

- **Application of Ultra-high-performance Concrete (UHPC) in Bridge Design and Bridge Deck Retrofit**

- Studied the interface slip resistance between UHPC and normal concrete in a composite beam.
- Investigated the strain reduction on the steel decks with a UPHC overlay.

## TEACHING & MENTORING EXPERIENCE

---

**Course Instructor, CIV/ARCH ENG3201: Structural Analysis I** Aug. 2023 - May 2024  
Department of Civil, Architectural, and Environmental Engineering, Missouri University of Science and Technology

- Taught more than 100 junior and senior-level undergraduates in the study of structural analysis.
- Developed and delivered comprehensive lectures and interactive class activities.
- Conducted course assessments to help students understand the material and stay on track.

## PROFESSIONAL SERVICE

---

**Guest Editor**

- Infrastructures

**Journal Reviewer**

- Resources, Conservation and Recycling
- Construction Building and Materials
- Journal of Structural Design and Construction Practice (ASCE)
- Transportation & Development Institute (T&DI) (ASCE)
- Journal of Building Engineering
- Measurement
- International Journal of Corrosion
- Heliyon (Cell Press)

**Professional Association**

- American Society of Civil Engineers (ASCE)
- International Union of Laboratories and Experts in Construction Materials, Systems and Structures (RILEM)
- American Concrete Institute (ACI)
- American Society for Photogrammetry and Remote Sensing (ASPRS)