

# JONG-HYUN JEONG

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## ACADEMIC POSITION

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**Graduate Assistant, Civil Engineering**  
The University of Arizona

*January 2016 - Present*

## EDUCATION

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**Ph.D., Civil Engineering**  
The University of Arizona, Tucson, Arizona  
Advisor: Dr. Hongki Jo

*January 2016 - Present*

**M.S., Electrical & Computer Engineering**  
The University of Arizona, Tucson, Arizona  
Advisor: Dr. Gregory Ditzler

*Expected 2021 Spring*

**M.S., Civil Engineering**  
Konkuk University, Seoul, Korea  
Advisor: Dr. Yong-Hak Lee

*2/2015*

**B.S., Civil Engineering**  
Konkuk University, Seoul, Korea

*2/2013*

## RESEARCH INTERESTS

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Structural Health Monitoring, Wireless Sensor Development, Computer Vision based SHM, Signal Processing, Machine Learning, Deep learning, Deep Reinforcement Learning based Structural Design Automation

## GRANTS, HONORS AND AWARDS

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- UA Tech launch Innovation Challenge (\$20,000, PI) *2020*  
*Convolutional Neural Networks for Pavement Roughness Assessment Using Calibration-Free Vehicle Dynamics (UA20-237)*
  - Collected smartphone-measured data on vehicle dynamics from fifty vehicles
  - Deep learning model development for calibration-free pavement roughness estimation
  - Real-time pavement roughness estimation smartphone app development
  - Cloud system development for crowd sourced data management
- Lewis, Delbert R Graduate Fellowship *2017, 2019, 2020*
- 3rd Place (poster), 15th Arizona Pavements/Materials conference *2018*
- 1st Place (poster), CEEM Poster Contest *2018*
- Travel grant, UA College of Engineering *2018*
- Whitenack & Dr. Russell D. Scholarship *2017*
- University designated scholarship, Konkuk University *2010*

## RESEARCH EXPERIENCE

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**Graduate Student Researcher**  
*Smart Structure Systems Laboratory*  
*The University of Arizona, Civil & Architectural Engineering & Mechanics*

*1/2016 - Current*

- Faculty Advisor: Hongki Jo, Ph.D.
- **RL based Artificial Structural Designer Development: Reinforcement Learning based Structural Design Automation**
  - Design and implementation of a framework for agent based automated reinforced concrete beam design using reinforcement learning based on ACI-318 provision
  - Formulated the structural designing task in Markov Decision Process
  - Developed design environment & reward strategy to train an RL agent to design structure in autonomous manner
- **Crowd-sourced Smartphone Sensor Data for Real-time Pavement Condition monitoring** (Funding: UA Tech Launch # UA20-237)
  - Developed a calibration-free smartphone based pavement roughness estimation strategy using deep learning method
  - Developed a convolutional neural network architecture to estimate pavement roughness independent from vehicle mechanical characteristics and driving speed
  - Collected an experimental dataset from various vehicle dynamics measurement
  - Developed a smartphone application for practical implementation
  - Developed a cloud based data management system
- **Wind-induced Vibration Investigation and Mitigation for Jojoba Substation A-frame Structure** (Funding: Salt River Project)
  - Proposed a deep learning and computer vision-based structural displacement monitoring technique considering environmental uncertainties(i.e., illumination change, fog, rain and occlusion)
  - Developed a Computer vision-based long-term structural dynamic displacement monitoring system (Hardware system & software development)
  - Low-cost micro-burst identification & monitoring IoT device development
- **Flood Induced Bridge Scour Prediction Using Bio-Inspired Smart Sensor Network** (Funding: National Science Foundation, Grant # 1434923)
  - Developed an IoT edge device based scour monitoring system
  - Installed the system on La Cholla Bridge and monitored scour for 2 years
  - Developed a signal processing technique using hydrophone for scour level estimation
- **Strain-based Fatigue Crack Monitoring of Steel Bridges using Wireless Elastomeric Skin Sensors** (Funding: Transportation pooled Fund, Grant # TPF-5(328))
  - Developed a wireless high-sensitive capacitive sensing node
  - Proposed a two-step shunt-calibration method for capacitive sensor calibration
  - Integrated developed sensor unit to a new high fidelity sensor platform-Xnode for I-70 bridge fatigue monitoring
- **Wind-induced Structural Risk Monitoring System Development for SRP Power Substation and Transmission Structures** (Funding: Salt River Project)
  - Analyzed aerodynamic characteristics A-frame conductor beam using CFD
  - Wind-tunnel test analysis for conductor beam retrofitting
- **Robust Wireless Skin Sensor Networks for Long-term Fatigue Crack Monitoring of Bridges** (Funding: Transportation pooled Fund, Grant # TPF-5(556))
  - Automated high-frequency AC bridge balancing method development
  - Developed digitally controlled capacitance shunt calibration strategy

Concrete Structure Laboratory  
Konkuk University, Civil Engineering

- Faculty Advisor: Yong-Hak Lee, Ph.D.

**- Development of Torsional Rotation Control Technique for Curved Prestressed Curved Concrete Girder Bridge**

(Funding: Korea Agency for Infrastructure Technology Advancement, Grant # 12CCTI-C063718-01)

- Formulated time dependent bending/torsional creep behavior in concrete & experimental validation
- Formulated Non-uniform bending shrinkage behavior in concrete beam & experimental validation
- Developed tensile & torsional creep testing machines
- Scaled two-span curved, continuous double-t post-tensioned girder bridge design/construction
- Experimental validation of time-dependent torsion control of curved double-t girder bridge via asymmetrical tendon tensioning technique

## PUBLICATIONS

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### Journal Publications

- [J1] **Jeong J. H.**, Jo H., Real-time generic target tracking for long-term structural displacement monitoring under environmental uncertainties via deep learning *Structural control and health monitoring*, (in review)
- [J2] **Jeong J. H.**, Jo H., Deep reinforcement learning for automated reinforced concrete structure design *Computer-Aided Civil and Infrastructure Engineering*, (in review)
- [J3] **Jeong J. H.**, Jo H., Ditzler G. (2020) Convolutional neural networks for pavement roughness assessment using calibration-free vehicle dynamics. *Computer-Aided Civil and Infrastructure Engineering*.1–21.,(IF: 8.552) <https://doi.org/10.1111/mice.12546>
- [J4] **Jeong, J. H.**, Xu, J., Jo, H., Li, J., Kong, X., Collins, W., ... & Laflamme, S. (2018). Development of wireless sensor node hardware for large-area capacitive strain monitoring. *Smart Materials and Structures*, 28(1), 015002., (IF: 3.613) <https://doi.org/10.1088/1361-665X/aaebc6>
- [J5] **Jeong, J. H.**, Park, Y. S., & Lee, Y. H. (2015). Variation of shrinkage strain within the depth of concrete beams. *Materials*, 8(11), 7780-7794.,(IF: 3.057) <https://doi.org/10.3390/ma8115421>
- [J6] Lee, T., **Jeong, J. H.**, Kim, H. J., & Lee, Y. H. (2015). Interface behavior of concrete infilled steel tube subjected to flexure. *Journal of The Korean Society of Civil Engineers*, 35(1), 9-17., (IF: 1.515) <https://doi.org/10.12652/KSCE.2015.35.1.0009>
- [J7] Lee, Y. H., Lee, T., **Jeong, J. H.**, Kim, H. J., & Park, K. T. (2014). Interface behavior of concrete infilled steel tube composite beam. *Journal of the Korea institute for structural maintenance and inspection*, 18(5), 9-18. <https://doi.org/10.11112/jksmi.2014.18.5.009>

### Journal Publications in Progress

- [P1] **Jeong J. H.**, Jo H., "Development of deep-learning based real-time pavement roughness assessment smart-phone application and experimental validation" (in preparation)
- [P2] **Jeong J. H.**, Jo, H., Li, J., Collins, W., Laflamme, S. "Fully automated wireless capacitive strain sensing node development for high-sensitive, large area strain monitoring" (in preparation)
- [P3] **Jeong J. H.**, Jo H., "Vision based long-term dynamic displacement monitoring system development and validation for wind induced structural vibration monitoring" (in preparation)

### Conference publications

- [C1] **Jeong, J. H.**, Xu, J., Jo, H., Li, J., Kong, X., Collins, W., ... & Laflamme, S. (2018, March). Capacitance-based wireless strain sensor development. In *Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2018* (Vol. 10598, p. 105980S). International Society for Optics and Photonics.

- [C2] Kong, X., Li, J., Collins, W., Bennett, C., Jo, H., **Jeong, J. H.**, & Laflamme, S. (2018, March). Dense capacitive sensor array for monitoring distortion-induced fatigue cracks in steel bridges. In *Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2018* (Vol. 10598, p. 105980Q). International Society for Optics and Photonics.
- [C3] Ahamed, T., Shim, J., **Jeong, J. H.**, Jo, H., & Duan, J. G. (2017, May). Advanced Signal Processing of Sonar Measurement for Bridge Scour Monitoring. In *World Environmental and Water Resources Congress 2017* (pp. 93-100).
- [C4] Lee, S. W., **Jeong, J. H.**, Knez, K. P., Min, J. H., & Jo, H. (2016, April). Practical application of RINO, a smartphone-based dynamic displacement sensing application for wind tunnel tests. In *Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2016* (Vol. 9803, p. 98032X). International Society for Optics and Photonics.
- [C5] **Jeong, J. H.**, Park, Y. S., Lee, Y. H., (2015, Oct.) Time-dependent experiment of two-span curved double-t beam, *KSCE 2015 CONVENTION 2015 CIVIL EXPO & CONFERENCE*, (pp. 19-20)
- [C6] Park, Y. S., **Jeong, J. H.**, Kim, H. J., Lee, Y. H., (2015, Oct.) Torsional Effect of Bimoment due to Prestressing Force in Double-T Beam, *KSCE 2015 CONVENTION 2015 CIVIL EXPO & CONFERENCE*, (pp. 97-98)
- [C7] **Jeong, J. H.**, Park, Y. S., Kim, H. J., Lee, Y. H., (2015, April) Age-dependent torsional behavior of prestressed double-T beam In *2015 The Korea Institute for Structural Maintenance and Inspection Spring Conference & Forum* (pp. 431-434)
- [C8] **Jeong, J. H.**, Park, Y. S., Kim, H. J., Lee, Y. H., (2015, April) Torsion control of prestressed curved girder with prestressing force. In *2015 The Korea Institute for Structural Maintenance and Inspection Spring Conference & Forum* (pp. 361-364)
- [C9] **Jeong, J. H.**, Kim, H. J., Lee, Y. H., (2014, April) Torsional behavior of curved PSC girder. In *2014 The Korea Institute for Structural Maintenance and Inspection Spring Conference & Forum* (pp. 495-498)
- [C10] Park, Y. S., Shin, D. H., **Jeong, J. H.**, Kim, H. J., Lee, Y. H., (2013, Oct.) Shrinkage and creep under flexure in concrete beam., *KSCE 2013 CONVENTION*, (pp. 1462-1465)
- [C11] Park, Y. S., Shin, D. H., **Jeong, J. H.**, Kim, H. J., Lee, Y. H., (2013, Oct.) Single curve formulation of creep under time-varying stress history., *KSCE 2013 CONVENTION*, (pp. 1257-1261)

### Technical Reports

- Lee, Y.H., Park, Y.S., **Jeong, J. H.**, Kim, H.J., Kim, S.G., Park. S.H. (2015, Dec.), Development of Torsional Rotation Control Technique for Curved Prestressed Curved Concrete Girder Bridge: Final Project Report, Korea Agency for Infrastructure Technology Advancement

### PROPOSAL WRITING EXPERIENCES

#### UA Tech Launch

June 2020

Title: Convolutional Neural Networks for Pavement Roughness Assessment Using Calibration-Free Vehicle Dynamics

Role: Principle Investigator

(Funded)

- Entire proposal writing including technical opportunity, research plan, intellectual merit and budget plan

#### National Science Foundation: FW-HTF-RM

March 2019

Title: Collaborative Research: WAKE: Boosting construction workplace safety and efficiency through a fatigue prediction and intervention system

Role: Co-authored on behalf of Dr. Hongki Jo

(In review)

- Proposed experimental design & deep learning based EEG signal processing algorithm

#### Salt River Project

May 2018

Title: Wind-induced Vibration Investigation and Mitigation for Jojoba Substation A-frame Structure

Role: Co-authored on behalf of Dr. Hongki Jo (Funded)

- Proposed deep learning based long-term vision based displacement sensing strategy
- Proposed 24/7 vision based structure displacement monitoring system development
- Proposed low-cost microburst IoT device development

### **Department of Energy**

June 2018

Title: Using crowdsourced smartphone data to improve pavement management and energy efficiency of vehicles

Role: Co-authored on behalf of Dr. Hongki Jo (Not funded)

- Proposed smartphone crowdsourced pavement roughness estimation strategy

### **The Nature Conservancy**

May 2018

Title: Real-time tree diameter measurement using 3D point-cloud sensor

Role: Co-authored on behalf of Dr. Hongki Jo (Not Funded)

- Proposed LIDAR based signal processing algorithm

### **Salt River Project**

Oct. 2017

Title: Wind-induced Vibration Investigation and Mitigation for Jojoba Substation A-frame Structure

Role: Co-authored on behalf of Dr. Hongki Jo (Funded)

- Authored CFD analysis section

### **PATENT**

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- Deep reinforcement learning for automated reinforced concrete structure design (US patent pending)

### **TEACHING EXPERIENCE**

#### **Instructor of Record**

*The University of Arizona, Civil & Architectural Engineering & Mechanics*

- CE 389: Material Testing Laboratory *Fall 2019, Spring 2020*
  - Instructed lecture & lab session of about 40 students each semester
  - Created homeworks, exams, and evaluated student's works
  - Updated class contents: "Fundamental of Sensing in Civil Engineering"

#### **Teaching Assistant**

*The University of Arizona, Civil & Architectural Engineering & Mechanics*

- CE 214: Statics (Discussion session) *Fall 2018*
  - Instructed three discussion sessions per week

*Konkuk University, Civil Engineering*

- Concrete as Material Engineering *Fall 2013, Fall 2014*
  - Instructed lab session of about 40 students each semester

### **STUDENT MENTORING**

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- Chelsey Bergmann, Undergraduate in Computer Science, UA
    - Topic: Real-time pavement roughness monitoring cloud platform development using smartphone crowdsourced data

- Deep learning based iOS app development for crowdsourced pavement roughness monitoring
- Cloud platform development using firebase for crowdsourced data management
- Jongkwang Park, Undergraduate in Mechanical Engineering, UA
- Topic: Single camera based 6-DOF displacement monitoring technique development
- Single camera based 3D displacement measurement technique using planar homography, depth calibration, and optimization techniques

## SERVICE ACTIVITIES

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Summer Engineering Camp Assistant *2016-present*

- Introductory lecture of structural engineering & bridge competition
- Updated lecture with new topics (Structural dynamics and sensors)
- Designed new competition content (Building competition under earthquake excitation)

## AFFILIATION

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Data Science Institute Member, *The University of Arizona* *2020*

## TECHNICAL SKILLS

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### Engineering tools

*ANSYS, FLUENT, MIDAS CIVIL, SAP, AUTODESK REVIT*

### Programming Languages

*Python, MATLAB, Simulink, Stateflow, C, FORTRAN, Mathematica, Objective-C, Swift*

### Library & API

*Tensorflow, Pytorch, Keras, Scikit-learn, Scipy, Pandas, Singularity, Amazon web service, Dash*

## PROFESSIONAL LICENSES

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Civil Engineer License, South Korea, 2013

## LANGUAGE PROFICIENCY

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Fluent in *English*, Native in *Korean*