Jice Zeng
patrickjice@gmail.com

EDUCATION

University of Louisville, Louisville, KY, USA ***Aug. 2017-Dec. 2021***
Ph.D. in Civil and Environmental Engineering (Structural Engineering) GPA 4.0/4.0

- Advisor: Young Hoon Kim
- Ph.D. Dissertation Title: Hybrid Structural Health Monitoring Using Data-driven Modal analysis and Model-based Bayesian Inference

Chongqing Jiaotong University, Chongqing, China ***Sept. 2013-Jun. 2016***
M.Sc. in Civil Engineering GPA 85/100

Nottingham Trent University, Nottingham, United Kingdom ***Feb. 2015-May 2015***
International Student Exchange Program

Xihua University, Chengdu, China ***Sept. 2009-Jun. 2013***
B.S. in Civil Engineering GPA 3.5/4.0

PROFESSIONAL EXPERIENCE

Pacific Northwest National Laboratory, WA, USA ***Jan.2024-present***
Post Doctorate RA - Computational Math ***Richland, WA***

1. **Project:** High-Dimensional Model Inversion and Uncertainty Quantification for Complex Systems

University of Michigan-Dearborn, MI, USA ***Jan.2022-Dec.2023***
Senior Research Fellow

1. Machine learning-based projects

- "Machine Learning Enabled Fusion of Physics-Based CAE Data and Test Data for Accelerated Certification by Analysis" funded by Ford Motor Company (AWD018165) (implemented by PyTorch, TensorFlow, Scikit-Learn, etc.)
- "Information fusion for remaining useful life estimation and reliability assessment" funded by Hottinger Bruel & Kjaer (AWD014173) (implemented by PyTorch, TensorFlow, Scikit-Learn)
- "Uncertainty quantification of Hydrologic Models" funded by the U.S. Army (AWD019444) (implemented by PyTorch, TensorFlow, Scikit-Learn, etc.)
- "Likelihood-Free Calibration Approaches for Correlation of CAE Model and Tests with Incomplete Information" funded by Ford Motor Company (AWD024057) (implemented by PyTorch, TensorFlow, Scikit-Learn, etc.)

2. Structural health monitoring (SHM)

- UAV-based autonomous structural damage detection for miter gate
- Structural damage detection using likelihood-free inference
- Reliability analysis and remaining useful life estimation for miter gate

3. Vehicle crashworthiness design

- Model bias correction to improve predictive performance for vehicle crashworthiness

4. Streamflow

- Bayesian model calibration for RAPID model parameters

University of Louisville, KY, USA ***Sept. 2017-Dec. 2021***
Research Assistant

1. Structural health monitoring (SHM)

- Detected damage and quantified damage of steel members using non-contact optical sensor (high-speed camera)
- Developed the automated operational modal analysis strategies for in-service steel pedestrian bridge and a concrete highway bridge
- Presented an algorithm of automated Bayesian modal analysis for parameter estimation and uncertainty quantification
- Proposed a novel Bayesian model updating framework to simultaneously identify mass and stiffness and further implement probabilistic damage detection
- Enhance Bayesian approach with DREAM sampling method and Kriging model to advance model updating performance and computational efficiency

Chongqing Jiaotong University, Chongqing, China ***Oct. 2013-May 2016***
Research Assistant

1. Construction analysis and management

- Investigated construction stages of city viaduct casting-in-place and examined stability of scaffold
- Discussed and optimized theoretically the way to pour concrete stiff skeleton arch bridge by means of AutoCAD (for drawings) and Midas/civil (for 3D Finite Element Model)

2. Evaluation of Material performance

Evaluated fatigue and mechanical performance of bamboo bridge under varied conditions such as heat and moisture

- Assessed effect of fiber material (glass-steel plate) on strength of concrete

HONORS AND REWARDS

- **2023,** Paper of Distinction, ASME 2023 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, Boston, MA
- **2021**, Doctoral Dissertation Completion Award at University of Louisville, Louisville, KY
- **2019**, International Student Tuition Support Award at University of Louisville, Louisville, KY
- **2018**, Graduate Student Council Travel Funds at University of Louisville, Louisville, KY
- **2017~2018**, International student fellowship, University of Louisville, Louisville, KY
- **2013-2015**, University Scholarship, Chongqing University, Chongqing, China

PUBLICATIONS

- **Published:**

1. **Zeng, Jice.**, and Kim, Y.H., (2020). Identification of Structural Stiffness and Mass using Bayesian Model Updating Approach with Known Added Mass: Numerical Investigation. Published in *International Journal of Structural Stability and Dynamics* (IF=3.6) https://doi.org/10.1142/S0219455420501230
2. **Zeng, Jice.**, and Kim, Y.H., (2021). A Two-stage Framework for Automated Operational Modal Identification. Published in *Structure and Infrastructure Engineering* (IF=3.7) https://doi.org/10.1080/15732479.2021.1919151

3. **Zeng, Jice.**, and Kim, Y.H., (2021). Stiffness Modification Based Bayesian Finite Element Model Updating to Solve Coupling Effect of Structural Parameters: Formulations. Published in *Applied Sciences* (IF=2.8)
   https://doi.org/10.3390/app112210615
4. **Zeng, Jice.**, and Kim, Y.H., (2021). Probabilistic Damage Detection and Identification of Coupled Structural Parameters using Bayesian Model Updating with Added Mass. Published in *Journal of Sound and Vibration*. (IF=4.7)
   https://doi.org/10.1016/j.jsv.2022.117275
5. **Zeng, Jice.**, Xie, Yan-long., Kim, Y.H., and Wang, Junfang. (2021). Automation in Bayesian Operational Modal Analysis Using Clustering-based Interpretation of Stabilization Diagram. Published in *Journal of Civil Structural Health Monitoring*. (IF=4.4)
   https://doi.org/10.1007/s13349-022-00644-7
6. **Zeng, Jice.**, and Hu, Zhen., (2022). Automated operational modal analysis using variational Gaussian mixture model. Published in *Engineering Structure*. (IF=5.5)
   https://doi.org/10.1016/j.engstruct.2022.115139
7. **Zeng, Jice.**, and Hu, Zhen., (2022). Probabilistic damage detection using a new likelihood-free Bayesian inference method. Published in *Journal of Civil Structural Health Monitoring*. (IF=4.4)
   https://doi.org/10.1007/s13349-022-00638-5
8. **Zeng, Jice.**, Wu, Zihan., Todd, Michael D., and Hu, Zhen., (2022). Bayes Risk-Based Mission Planning of Unmanned Aerial Vehicles for Autonomous Damage Inspection. Published in *Mechanical Systems and Signal Processing*. (IF=8.4)
   https://doi.org/10.1016/j.ymssp.2022.109958
9. Liu, Yixuan., Barthlow, Dakota., Mourelatos, Zissimos P., **Zeng, Jice**., Gorsich, David., Singh, Amandeep., Hu, Zhen., (2022). Mobility Prediction of Off-Road Ground Vehicles Using a Dynamic Ensemble of NARX Models. Published in *Journal of Mechanical Design.* (IF=3.4)
   https://doi.org/10.1115/1.4054908
10. **Zeng, Jice.**, and Kim, Y.H., and Qin, Shiqiang., (2023). Bayesian Model Updating for Structural Dynamic Applications Combing Differential Evolution Adaptive Metropolis (DREAM) and Kriging Model, published in *Journal of Structural Engineering*. (IF=3.8)
    https://doi.org/10.1061/JSENDH.STENG-10837
11. **Zeng, Jice.**, Guosong, Li., Zhenyan, Gao., Yang, Li., Srinivasan, Sundararajan., Saeed, Barbat., and Hu, Zhen., (2023). Machine Learning Enabled Fusion of CAE Data and Test Data for Vehicle Crashworthiness Performance Evaluation by Analysis, published in *Structural and Multidiscipline Optimization*. (IF=4.2)
    https://doi.org/10.1007/s00158-023-03553-5
12. **Zeng, Jice.**, Todd, Michael D., and Hu, Zhen., (2023). A Recursive Inference Method Based on Invertible Neural Network for Multi-Level Model Updating Using Video Monitoring Data, published in *Mechanical Systems and Signal Processing*. (IF=8.4)
    https://doi.org/10.1016/j.ymssp.2023.110736
13. Wu, Zihan., **Zeng, Jice.**, Hu, Zhen., and Todd, Michael D., (2023). Unmanned Aerial Vehicles Inspection Optimization for Large-scale Structures Based on Model-Enabled Diagnostics and Prognostics, published in *Mechanical Systems and Signal Processing*. (IF=8.4)
    https://doi.org/10.1016/j.ymssp.2023.110841
14. **Zeng, Jice.**, Zhao, Ying., Guosong, Li., Zhenyan, Gao., Yang, Li., Saeed, Barbat., and Hu, Zhen., (2023). Vehicle Crashworthiness Performance Prediction through Fusion of Multiple Data Sources, published in *Journal of Mechanical Design*. (IF=3.4)
    https://doi.org/10.1115/1.4064063
15. Zeng, Yichao., **Zeng, Jice.**, Todd, Michael D., and Hu, Zhen., (2024). Data Augmentation Based on Image Translation for Bayesian Inference-Based Damage Diagnostics of Miter Gates, published in *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems Part B: Mechanical Engineering.* (IF=2.2)
16. Qian, Guofeng., **Zeng, Jice**., Hu, Zhen., Todd, Michael D., (2024). Bayesian Model Updating of Multiscale Simulations Informing Corrosion Prognostics Using Conditional Invertible Neural Networks, published in *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems Part B: Mechanical Engineering.* (IF=2.2)

17. **Zeng, Jice.**, Zhenyan, Gao., Yang, Li., Saeed, Barbat., Lu, Jin., and Hu, Zhen., (2024). Fusion of Multiple Data Sources for Vehicle Crashworthiness Prediction Using CycleGAN and Temporal Convolutional Networks, published in *Journal of Mechanical Design*. (IF=3.4)
18. **Zeng, Jice.**, Todd, Michael D., Zhao, zhao., and Hu, Zhen., (2024). Model Uncertainty Quantification of a Degradation Model of Miter Gates Using Normalizing Flow-based Likelihood-free Inference, published in *Structural Health Monitoring* (IF=5.7)
19. **Liu, Luling, Chen, Hui. ,Wang, Song., and Zeng, Jice**, (2024). A Comparative Study of Single-chain and Multi-chain MCMC Algorithms for Bayesian Model Updating-Based Structural Damage Detection, published in *Applied Sciences*. (IF=2.8)
20. **Zeng, Jice.**, Kaiyi Xue., Hui Chen., (2024). Real-time Probabilistic Model Updating and Damage Detection Using Machine Learning-based Likelihood-free Inference, submitted to *Mechanical Systems and Signal Processing*. (Under review)

- **Conference publication:**

1. **Zeng, Jice.**, and Kim, Y.H., and Qin, Shiqiang., (2021). Bayesian Model Updating for A Cable-stayed Pedestrian Bridge using DREAM and Kriging Model. *The 13th International Workshop on Structural Health Monitoring (IWSHM), Stanford University, CA*
2. Hu, Zhen., Yixuan., Barthlow, Dakota., Mourelatos, Zissimos P., Gorsich, David., Singh, Amandeep., **Zeng, Jice** (2022). Mobility Prediction of Off-Road Ground Vehicles Using a Dynamic Ensemble of NARX Models. *ASME 2022 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*
3. **Zeng, Jice.**, Todd, Michael D., and Hu, Zhen., (2022). Probabilistic Damage Detection using A New Likelihood-free Bayesian Inference Method. *IMAC-XLI Conference & Exposition, Austin, TX*.
4. **Zeng, Jice.**, Ying, Zhao., Guosong, Li., Zhenyao, Gao., Yang, Li., Saeed, Barbat., Hu, Zhen. (2023). Machine Learning-based Model Bias Correction by Fusing CAE Data With Test Data for Vehicle Crashworthiness. *ASME 2023 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference*
5. **Zeng, Jice.**, Todd, Michael D., and Hu, Zhen., (2023). Degradation Model Updating For Failure Prognostic Using Sequential Likelihood-free Bayesian Inference And Computer-Vision-Based Measurement. *The 14th International Workshop on Structural Health Monitoring (IWSHM), Stanford University, CA*
6. **Zeng, Jice.**, Todd, Michael D., and Hu, Zhen., (2023). Dynamic State Estimation via Likelihood-Free Bayesian Inference Based on Conditional Invertible Neural Networks. *IMAC-XLI Conference & Exposition, Orlando, FL*.

- **Book chapter**

Zeng, Jice., Wu, Zihan., Vega, Manuel A., Todd, Michael D., and Hu, Zhen., "Fast Probabilistic Damage Detection Using Inverse Surrogate Models", *Data-Centric Structural Health Monitoring*, Mohammad Noori, Fuh-Gwo Yuanand Ehsan Noroozinejad Farsangi (Eds.), De Gruyter Book on Data-Centric Engineering, 2023, ISBN 978-3-11-079127-3

PEER-REVIEWED CONFERENCE PROCEEDINGS AND PRESENTATION

- **AGU24 Annual Meeting 2024** ***Dec. 2024***
  Presented research: 'Solving High-dimensional inverse problems using amortized likelihood-free inference and Karhunen–Loève expansions', *Washington, D.C., USA*

- **14th International Workshop on Structural Health Monitoring (IWSHM)** ***Sept. 2023***
  Presented research: 'Degradation Model Updating For Failure Prognostic Using Sequential

Likelihood-free Bayesian Inference And Computer-Vision-Based Measurement', *Stanford University, CA*

- **International Design Engineering Technical Conferences & Computers and Information in Engineering Conference** ***Aug. 2023***
  Presented research: 'Machine Learning-based Model Bias Correction by Fusing CAE Data With Test Data for Vehicle Crashworthiness.', *Boston, MA*

- **IMAC XLI Society Experimental Mechanics** ***Feb. 2023***
  Presented research: 'Probabilistic damage detection using a new likelihood-free Bayesian inference method', *Austin, TX*

- **13th International Workshop on Structural Health Monitoring (IWSHM)** ***March. 2022***
  Presented research: 'Bayesian Model Updating for with Differential Evolution Adaptive Metropolis (DREAM) Sampling Method and Kriging Model', *Stanford University, CA*

- **Engineering Mechanic Institute Conference (EMI)** ***May. 2018***
  Presented research: 'Damage Identification and Damage Quantification Using Time-Variant Visual Images', *Massachusetts Institute of Technology, Boston*

- **Graduate Student Regional Research Conference (GSRRC**) ***March. 2018***
  Presented research: 'Applicability of Static Condensation to Estimate Stiffness Loss Using Non-contact Based Sensors', *University of Louisville, KY*

JOURNAL REVIEW

34 peer-review journals in *Structural and Multidisciplinary Optimization, Journal of Verification, Validation and Uncertainty Quantification, practice periodical on structural design and construction, Journal of Mechanical Design, Journal of Sound and Vibration,* including various fields, such as structural damage detection, reliability analysis, uncertainty quantification, model updating and fault diagnosis.

PROFESSIONAL SKILLS

Bayesian Inference, Structural Dynamics, Uncertainty Quantification, Machine Learning, Optimization Under Uncertainty, and Applications of Data Analytics and Machine Learning in Civil And Mechanical Systems.

Proficient tools: Python, PyTorch, TensorFlow, Scikit-Learn, Machine learning models, Visualization tools (Matplotlib, Seaborn)

TEACHING

University of Louisville, Department of Civil and Environmental Engineering ***May. 2019- July. 2021***
Teaching assistant:

- CEE 322-Structural Analysis *Summer, 2019*
  - Facilitated learning for a section of 25 students focusing on the analysis of structural elements.
  - Held weekly discussions and Q&A sessions to clarify complex concepts like load distribution, deflection, and stress-strain relations.
  - Developed three comprehensive assignments to evaluate the students' ability to apply

theoretical concepts in real-world structural challenges

- CEE 470-Surface Water Hydrology *Fall, 2019*
  - ○ Managed a class section of 20 students specializing in civil and environmental engineering.
  - ○ Conducted bi-weekly lab sessions to explore hydrological models and water flow simulations.
  - ○ Prepared three extensive case studies to help students understand the impact of surface water systems on flood control and water resources management.

- CEE 421-Concrete Design *Spring, 2020*
  - ○ Led a section of 30 students in applying principles of reinforced concrete design.
  - ○ Organized monthly workshops for hands-on experience with concrete mix design and testing.
  - ○ Formulated two major projects aimed at practical applications of concrete in structural elements like beams, columns, and slabs.

- CEE 322-Structural Analysis *Summer, 2020*
  - ○ Co-taught a course section of 30 students, focusing on the theoretical and practical aspects of analyzing structural systems.
  - ○ Offered bi-weekly tutorial sessions aimed at reinforcing concepts taught in lectures, such as moment distribution, truss analysis, and shear and bending moment diagrams.
  - ○ Managed a course forum where students could discuss course material and problem-solving techniques, fostering a collaborative learning environment.

- CEE 422-Steel Design *Fall, 2020*
  - ○ Assisted in instructing a section comprising 25 engineering students.
  - ○ Conducted weekly office hours to offer personalized instruction, clarify course materials, and address specific queries.
  - ○ Developed four problem sets centered on real-world applications of steel design, emphasizing topics like load distribution, connection design, and stability.

- CEE 421-Concrete Design *Spring, 2021*
  - ○ Managed one section comprising 25 students, emphasizing fundamentals of reinforced concrete design.
  - ○ Held weekly office hours to clarify doubts regarding concrete mix design, flexural analysis, and other topics.
  - ○ Assigned two hands-on projects involving the comprehensive design of reinforced concrete structures like beams, slabs, and columns.

- CEE 471-Water Supply and Sewerage *Spring, 2021*
  - ○ Oversaw one section with 30 students, focusing on water treatment and waste disposal systems.
  - ○ Conducted bi-weekly workshops on hydraulic modeling and water quality analysis.
  - ○ Prepared and graded two major projects requiring students to design sustainable water supply and sewerage systems for hypothetical communities.

- CEE 322-Structural Analysis *Summer, 2021*
  - ○ Facilitated one section of 20 students, focusing on load distribution, truss analysis, and structural stability.
  - ○ Conducted weekly tutorial sessions to address questions on topics such as shear and moment diagrams.
  - ○ Administered four quizzes and one final project that required students to perform structural analysis on a model building, using both manual calculations and software tools.

INDUSTRIAL EXPERIENCE

The Eleventh Metallurgical Construction Group Co. LTD ***Aug. 2016-Jul 2017***
Working as construction manager *Sichuan, China*

- Managed construction stage and supervised for Resettlement Housing Project worth $28.8M, including construction flow, risk, and safety assessment
- Cooperated with contractors, landscape architects and structural engineers
- Conducted inspection to confirm each construction item as per design drawing and relevant Chinese standards
- Resolve technical issues during project execution to meet design requirement

Sichuan Provincial Transport Department Highway Planning, Survey, Design, and Research Institute ***Oct. 2015-Dec. 2015***
Civil Engineering Intern *Sichuan, China*

- Joined a team of 10 personnel which directed professional and high-quality service, including:
  - Initiated design for bridge, retaining wall and culvert, specification, and initial cost estimates
  - Examined existing structure and provided efficient and economical maintenance plan
  - Reported on above programs, condition assessment and progress evaluation
- Coordinated site meetings with contractors, construction agencies

Chongqing Communications Planning Survey and Design Institute ***Jun. 2015-Sept. 2015***
Civil Engineering Intern *Chongqing, China*

- Provided input to design, drawings using AutoCAD, wrote specification, created cost estimates and project presentation using Excel, Word, PowerPoint for municipal bridges projects
- Gathered information on project using Total Station device and GPS