ZHENKUN LI, DOCTOR OF SCIENCE — CURRICULUM VITAE

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Interest: structural health monitoring, damage detection, drive-by bridge inspection, model updating, deep learning, Bayesian theory, Gaussian processes, computer vision, engineering optimization.
Strengths: mathematics, computer programming, finite element analysis, signal processing.

DEGREES

10.2021-10.2023 **Doctor of Science (D.Sc.),** Structural Engineering, GPA: 4.63/5.0.
School of Engineering, Aalto University, Espoo, Finland.
Thesis: *Bridge health condition assessment using instrumented moving vehicles* (with distinction).

09.2017-06.2020 **Master of Engineering (M.Eng.),** Structural Engineering, GPA: 3.76/4.0.
Faculty of Infrastructure of Engineering, Dalian University of Technology (DUT), Dalian, China.
Thesis: *Additional Virtual Mass Damage Identification Method Based on Narrow Band Frequency Responses* (with distinction).

09.2013-06.2017 **Bachelor of Engineering (B.Eng.),** Civil Engineering, GPA: 3.54/4.0 (WES Evaluation).
School of Civil Engineering, Qingdao University of Technology (QUT), Qingdao, China.
Diploma thesis: *Architecture and structural design of HOTEL SWAN LAKE at Changdao*.

WORK EXPERIENCE

11.2023-Present **Aalto University, Espoo, Finland. Postdoctoral Researcher.**
Research on structural health monitoring, vehicle scanning methods, and machine learning.

10.2021-Present **Aalto University, Espoo, Finland. Teaching Assistant.**
Fall 2022, 2023: Teaching Assistant for the master course Maintenance and Repair of Structures (by Prof. Weiwei Lin) at Department of Civil Engineering at Aalto University.
Fall 2021: Teaching Assistant for the undergraduate course Fundamentals of Structural Design (by Dr. Markou Athanasios) at Department of Civil Engineering at Aalto University.

04.2021-09.2021 **Beijing Smartbow Information Technology Co., Ltd., Beijing, China. Structural Algorithm Engineer.**
Develop algorithms for structural health monitoring, operational modal analysis by Python and MATLAB.

07.2020-03.2021 **TCDRI, Sinoma International Co., Ltd., Tianjin, China, Structural Engineer**.
Structural design using PKPM, YJK, Midas and AutoCAD, and Revit development (using C#).

RESEARCH PROJECTS

- Jane and Aatos Erkko Foundation in Finland, Grant number: 210018, Automated Inspection System for Bridges using Drive-By Method and Deep Learning (recipient: Weiwei Lin), 09/2021-08/2024, 346,000 €, ongoing, main investigator.
- National Natural Science Foundation of China (NSFC), Grant number 51878118, Structural damage identification and experiment study of slab track based on adding virtual physical parameters (recipient: Jilin Hou), 01/2019-12/2022, 680,000 ¥, Completed, main investigator.

PROFESSIONAL ACTIVITIES

- **Editorial**
  - ✧ **Early Career Editorial Board**, Smart Construction; Journal of Municipal Technology; Bridge Engineering (BREN).
  - ✧ **Guest editor**, "Evaluation of Buildings' and Infrastructures' Performance and Analysis of Seismic and Naturally Induced Disasters" in Applied Sciences.
  - ✧ **Guest editor**, for "Advanced Computer Vision Methods and Related Technologies in Structural Health Monitoring" in Structural Durability & Health Monitoring.
- **Membership**
  - ✧ Individual member of the International Association for Bridge Maintenance and Safety (IABMAS).
  - ✧ Individual member of the International Association for Life-Cycle Civil Engineering (IALCCE).
  - ✧ RILEM (Réunion Internationale des Laboratoires et Experts des Matériaux) staff member.
  - ✧ Student member of the American Society of Civil Engineers (ASCE).
- **Reviewers**
  - ✧ Automation in Construction, Mechanical Systems and Signal Processing, Construction and Building Materials, Engineering Structures, Journal of Building Engineering, Journal of Bridge Engineering (ASCE), Measurement, Journal of Civil Structural Health Monitoring, Journal of CO2 Utilization, Advances in Structural Engineering, Journal of Testing and Evaluation, etc.
- **Supervision**
  - ✧ Master thesis advisor, Yi Li: "Modal Parameter Extraction of a Bridge Subjected to Pulse Excitation from Passing Vehicles".

PERSONAL SKILLS & CERTIFICATES

- Mastered language: English (C1), Chinese (mother tongue), German (beginner).
- Chinese National Computer Rank Examination Certificate of Level 2, 3 (C programming language, Internet technology).
- Chinese National 1st Class Certified Structural Engineer.
- Chinese National Certificate of BIM Skill Proficiency Test Level 1.
- Main Software: Computing: MATLAB, Octave, Julia, R (tidyverse) | Languages: Python (sklearn+Pytorch) | Numerical simulation: ANSYS, Abaqus | Modeling: SOLIDWORKS, Revit | Text processing: MS Office, LaTeX, HTML5+CSS3 | Figures: OriginLab, Photoshop, Illustrator, Inkscape, CorelDRAW.

SELECTED AWARDS & HONOURS

02. 2024	Dean's doctoral dissertation awards	Aalto University
03. 2023	Incentive grant from Fabian and Jaakko Ahvenainen Foundation	Aalto University
06. 2020	Excellent master thesis	DUT
06. 2020	Eminent graduate in Liaoning Province	Liaoning Province
11. 2019	Scholarship of Chinese Road and Bridge	DUT
10. 2018	Eminent postgraduate student	DUT
10. 2016	Scholarship from Shandong Province Government (1 out of 508 students)	Shandong Province
12. 2015	Second Prize in National Mathematic Modeling Competition	National level
11. 2015	Third Prize in the National Advanced Innovated Competition	National level
06. 2015	Second Prize in the 14th Challenge Cup Competition in Shandong Province	Shandong Province
11. 2014	Scholarships from Principal of QUT (4 out of 508 students)	QUT

JOURNAL PUBLICATIONS

[16] **Li, Z.***, Lan, Y., Feng, K., & Lin, W. Investigation of time-varying frequencies of two-axle vehicles and bridges during their interaction using drive-by methods and improved multisynchrosqueezing transform. ***Mechanical Systems and Signal Processing***. 220, 111677. DOI: 10.1016/j.ymssp.2024.111677

[15] **Li, Z.***, Lan, Y., & Lin, W. Footbridge damage detection using smartphone-recorded responses of micromobility and convolutional neural networks. ***Automation in Construction***. 166, 105587. DOI: 10.1016/j.autcon.2024.105587

[14] **Li, Z.**, Lan, Y., & Lin, W*. (2024) Indirect frequency identification of footbridges with pedestrians using the contact-point response of shared scooters. ***Journal of Bridge Engineering***. 29, 04024036. DOI: 10.1061/JBENF2.BEENG-6344

[13] Lan, Y., **Li, Z.**, & Lin, W*. (2024). Physics-guided diagnosis framework for bridge health monitoring using raw vehicle accelerations. ***Mechanical Systems and Signal Processing***, 206, 110899. DOI: 10.1016/j.ymssp.2023.110899

[12] Lan, Y., **Li, Z.**, Koski, K., Fülöp, L., Tirkkonen, T., & Lin, W*. (2023). Bridge frequency identification in city bus monitoring: A coherence-PPI algorithm. ***Engineering Structures***, 296, 116913. DOI: 10.1016/j.engstruct.2023.116913

[11] Zhang, Y.*, **Li, Z.**, Hao, R., Lin, W., Li, L., & Su, D. (2023). High-fidelity time-series data synthesis based on finite element simulation and data space mapping. ***Mechanical Systems and Signal Processing***, 200, 110630. DOI: 10.1016/j.ymssp.2023.110630

[10] **Li, Z.**, Lin, W*., & Zhang, Y. (2023). Bridge Frequency Scanning Using the Contact-Point Response of an Instrumented 3D Vehicle: Theory and Numerical Simulation. ***Structural Control and Health Monitoring***, 2023, 3924349. DOI: 10.1155/2023/3924349

[9] **Li, Z.**, Lan, Y., & Lin, W*. (2023). Indirect damage detection for bridges using sensing and temporarily parked vehicles. ***Engineering Structures***, 291, 116459. DOI: 10.1016/j.engstruct.2023.116459

[8] **Li, Z.**, Lin, W*., & Zhang, Y. (2023). Drive-by bridge damage detection using Mel-frequency cepstral coefficients and support vector machine. ***Structural Health Monitoring***, 22(5), 3302-3319. DOI: 10.1177/14759217221150932.

[7] **Li, Z.**, Lin, W*., & Zhang, Y. (2023). Real-time drive-by bridge damage detection using deep auto-encoder. ***Structures***, 47, 1167-1181. DOI: 10.1016/j.istruc.2022.11.094

[6] Lan, Y., **Li, Z.**, & Lin, W*. (2023). A Time-Domain Signal Processing Algorithm for Data-Driven Drive-by Inspection Methods: An Experimental Study. ***Materials***, 16(7), 2624. DOI: 10.3390/ma16072624

[5] **Li, Z.**, Lan, Y., & Lin, W*. (2023). Investigation of Frequency-Domain Dimension Reduction for A2M-Based Bridge Damage Detection Using Accelerations of Moving Vehicles. ***Materials***, 16(5), 1872. DOI: 10.3390/ma16051872

[4] **Li, Z.**, Hou, J.*, & Jankowski, Ł. (2022). Structural damage identification based on estimated additional virtual masses and Bayesian theory. ***Structural and Multidisciplinary Optimization***, 65(2), 45. DOI:10.1007/s00158-021-03156-y

[3] Hou, J.*, **Li, Z.**, Zhang, Q., Jankowski, Ł., & Zhang, H. (2020). Local mass addition and data fusion for structural damage identification using approximate models. ***International Journal of Structural Stability and Dynamics***, 20(11), 2050124. DOI: 10.1142/S0219455420501242

[2] Hou, J.*, **Li, Z.**, Jankowski, Ł., & Wang, S. (2020). Estimation of virtual masses for structural damage identification. ***Structural Control and Health Monitoring***, 27(8), e2585. DOI: 10.1002/stc.2585

[1] Hou, J.*, **Li, Z.**, Zhang, Q., Zhou, R., & Jankowski, Ł. (2019). Optimal Placement of Virtual Masses for Structural Damage Identification. ***Sensors***, *19*(2), 340. DOI: 10.3390/s19020340

CONFERENCE PROCEEDINGS

[10] **Li, Z.***, Lan, Y., & Lin, W. Bridge damage classification using multiple responses of vehicles and 1-D convolutional neural networks, *12th International Conference on Bridge Maintenance, Safety and Management (IABMAS 2024)*, (2024), Copenhagen, Denmark, 24-28 June.

[9] Lan, Y.*, **Li, Z.**, & Lin, W. Crowd-Sensing Drive-by Monitoring for Bridge Frequency Identification, *12th International Conference on Bridge Maintenance, Safety and Management (IABMAS 2024)*, (2024), Copenhagen, Denmark, 24-28 June.

[8] **Li, Z.***, Lan, Y., & Lin, W. Crowdsensing-based automatic bridge health condition assessment using drive-by measurements and deep learning, *European Workshop on Structural Health Monitoring (EWSHM 2024)*, (2024), Potsdam, Germany, 10-13 June.

[7] Lan, Y.*, **Li, Z.**, & Lin, W. "Why Should I Trust You?": Exploring Interpretability in Machine Learning Approaches for Indirect SHM, *European Workshop on Structural Health Monitoring (EWSHM 2024)*, (2024), Potsdam, Germany, 10-13 June.

[6] **Li, Z.***, Lan, Y., & Lin, W. Using contact residual responses of a 3-DOF scooter to identify first few frequencies of the footbridge, *Tenth International conference: Experimental Vibration Analysis for Civil Engineering Structures (EVACES 2023)*, (2023), Milan, Italy, 31 August – 1 September.

[5] Lan, Y.*, **Li, Z.**, & Lin, W. Real-time diagnostic algorithm for bridge health monitoring using raw vehicle acceleration data, *Tenth International conference: Experimental Vibration Analysis for Civil Engineering Structures (EVACES 2023)*, (2023), Milan, Italy, 31 August – 1 September.

[4] **Li, Z.***, Lin, W., & Zhang, Y., Indirect bridge damage detection using frequencies identified from vibrations of a single two-axle vehicle, *Eighth International Symposium on Life-Cycle Civil Engineering (IALCCE 2023)*, (2023), Milan, Italy, 2-6 July.

[3] Lan, Y.*, **Li, Z.**, Zhang, Y., & Lin, W. Small-scale damage detection of bridges using machine learning techniques and drive-by inspection methods, *Eighth International Symposium on Life-Cycle Civil Engineering (IALCCE 2023*, (2023), Milan, Italy, 2-6 July.

[2] **Li, Z.***, Lin, W., & Zhang, Y. Drive-by Damage Detection in Bridges using Mel-frequency Cepstral Coefficients and Machine Learning, *8th World Conference on Structural Control and Monitoring (8WCSCM)*, (2022), Florida, U.S., 5-8 June.

[1] Zhang, Y.*, **Li, Z.**, Hao, R., Lin, W., Li, L., & Su, D. Vibration Data Synthesis by using Finite Element Analysis and Artificial Neural Network, *8th World Conference on Structural Control and Monitoring (8WCSCM)*, (2022), Florida, U.S., 5-8 June.

INVITED LECTURES

- ***Invited presentation***, Drive-by based bridge health monitoring and condition assessment: Lab and field tests, Advancing Bridge Sustainability: Workshop on Long-Term Indirect Monitoring, Espoo, Finland, 19 June 2024.
- ***Invited presentation***, Structural health monitoring for bridges based on vehicle responses, Chang'an Scholar Forum at Chang'an University, 14 December 2023.
- ***Invited Seminar***, Towards smart cities: indirect bridge health monitoring using responses of passing vehicles, Research Breakfast at Aalto University, 25 May 2023.

ORGANIZATION OF ACTIVITIES

- **12.2024**, organizer of the workshop "Advancing bridge sustainability: workshop on long-term indirect monitoring", in Espoo, Finland.
- **07.2025**, I will be one of the organizers of the special session "Indirect Structural Health Monitoring (iSHM) of transportation infrastructures using responses of passing vehicles" in 11th International Conference on Experimental Vibration Analysis of Civil Engineering Structure (EVACES 2025), 2-4 July 2025.
- **09.2025**, I will be the main organizer of the special session "Advances in Vibration-based Structural Health Monitoring for Bridge Structures" in 3rd Conference of the European Association on Quality Control of Bridges and Structures (EUROSTRUCT 2025), 2-5 September 2025.
- **09.2025**, I will be one of the organizers of the special session "Innovations in Structural Health Monitoring and Management towards Climate Resilient Transport Infrastructure" in 3rd Conference of the European Association on Quality Control of Bridges and Structures (EUROSTRUCT 2025), 2-5 September 2025.

INTERNATIONAL COLLABORATIONS

- **Institute of Fundamental Technological Research (IPPT PAN), Polish Academy of Sciences, Poland.** Model updating for structural damage detection and vibration-based vehicle parameter identification.
- **Anglia Ruskin University, U.K.** Vehicle-bridge interaction modeling, drive-by bridge health monitoring, smart city.
- **University of Central Florida, U.S.A.** Robots, computer vision applications in civil engineering, deep learning.