Hao Cheng
Curriculum Vitae

Personal Information
Date of Birth: 06 March 1995
Place of Birth: Qingdao, China
Nationality: Chinese
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Academic Qualifications
10/2020-11/2024
Ph.D., Concrete Structures, Delft University of Technology, The Netherlands
Thesis: ***Body wave transport properties in elastically deformed heterogeneous solids: application to concrete***
Supervisors: Assoc. Prof. Yuguang Yang, Asst. Prof. Katrin Löer, Prof. Max A. N. Hendriks
            Dr. Cornelis Weemstra (now work at KNMI)

09/2017-06/2020
M.Sc., Architecture and Civil Engineering, Dalian University of Technology, China
Thesis: ***Structural defect detection utilizing percussion and machine learning***
Supervisors: Prof. Gangbing Song (University of Houston), Prof. Linsheng Huo (Dalian University of Technology)

09/2013-06/2017
B.Sc., Civil Engineering, Qingdao University of Technology, China

Research Experience
10/2020-present
Ph.D. Research conducted at Delft University of Technology (TU Delft) focused on exploring acoustoelastic effects of ballistic and diffuse body waves in heterogeneous solids such as concrete. The doctoral thesis encompasses selecting techniques for estimating body wave properties (see publications [1] and [4] in the 'Publications' section below), investigating the acoustoelastic effect of ballistic body waves propagating in arbitrary directions (see publications [2] and [3]), studying the energy equilibration process of body waves in concrete (see publications [5] and [6]), and interpreting the acoustoelastic effect of diffuse body waves using acoustoelasticity and energy equilibration (see publication [7]). The entire thesis provides a theoretical foundation for utilizing body waves to detect variations in stress or strain in heterogeneous solids such as concrete.

In addition to theoretical and laboratory studies, I also participate in several long-term infrastructure monitoring projects. These projects involve monitoring of repaired concrete floor in the Maastunnel, Rotterdam (see the first conference presentation in the 'Publications' section below), monitoring of sustainable Kowebrêge bridge in Fryslân (see the second conference presentation), and monitoring of Fehmarn Belt Fixed Link between Scandinavia and the European mainland.

09/2017-06/2020
M.Sc. Research conducted at Dalian University of Technology focused on applying machine learning to enhance the accuracy of percussion techniques for structural health monitoring. Portions of the master's thesis have been adapted into a journal paper (refer to publication [8] in the 'Publications' section below).

Research Interests
My academic training and research experience have provided me with a solid foundation in various engineering disciplines, including **elastic wave-based structural health monitoring**, **wave interferometry techniques**, **non-linear elastodynamics**, and **energy transport of elastic waves in heterogeneous media**. I am interested in:
1. Wave interferometry techniques and its application in monitoring changes in concrete structures.
2. Non-linear elastodynamics and their relationship to changes in material properties.
3. Investigating the properties of heterogeneities in concrete using diffuse waves.

Skills

Computer Skills
Operating Systems: Microsoft Windows, Mac OS X
Programming languages: Matlab, Python
Languages
Proficient at English and Chinese (native)

Publications

Ph.D. thesis-related journal articles (including unpublished papers)

[1] **Cheng, H.**, Weemstra, C., Hendriks, M. A. N., & Yang, Y. (2024). Comparing the stretching technique and the wavelet cross-spectrum technique for measuring stress-induced wave-velocity changes in concrete. *Automation in Construction*, 158, 105221.

[2] **Cheng, H.**, Weemstra, C., Löer, K., Hendriks, M. A. N., & Yang, Y. Influence of elastic deformations on body wave velocity in solids: a theoretical re-evaluation and case study considering shear deformations in concrete. *Under review*

[3] **Cheng, H.**, Löer, K., Hendriks, M. A. N., & Yang, Y. Acoustoelastic parameters of inclined propagating longitudinal waves in concrete: theory and experimental validation. *To be submitted*

[4] **Cheng, H.**, Löer, K., Hendriks, M. A. N., & Yang, Y. Diffusive property of elastic waves in cementitious materials with planar boundaries. *To be submitted*

[5] **Cheng, H.**, Löer, K., Hendriks, M. A. N., & Yang, Y. Modelling energy equilibration of body waves in concrete. *To be submitted*

[6] **Cheng, H.**, Löer, K., Hendriks, M. A. N., & Yang, Y. Exploring elastic wave transport property in concrete via a scattering theory-based model. *To be submitted*

[7] **Cheng, H.**, Löer, K., Hendriks, M. A. N., & Yang, Y. Acoustoelastic effect of diffuse body waves in uniaxially stressed concrete. *To be submitted*

Other journal articles (including unpublished papers)

[8] **Cheng, H.**, Wang, F., Huo, L., & Song, G. (2020). Detection of sand deposition in pipeline using percussion, voice recognition, and support vector machine. *Structural Health Monitoring*, 19(6), 2075-2090.

[9] Huo, L., **Cheng, H. (co-first author)**, Kong, Q., & Chen, X. (2019). Bond-slip monitoring of concrete structures using smart sensors—A review. *Sensors*, 19(5), 1231.

[10] **Cheng, H.**, & Liang, M. Predicting the evolution of static elastic modulus during concrete hardening through longitudinal wave velocity changes retrieved by the stretching technique. *Construction and Building Materials*, 453, 139086.

[11] **Cheng, H.**, Zhang, S., Qian, Z., Ye, G., Lukovic, M., & Yang, Y. Monitoring precast prestressed alkali-activated concrete bridge with embedded smart aggregates: methodology and validation of performance indicators. *To be submitted*

[12] Sun, Y., **Cheng, H.**, Zhang, S., Mohan, M. K., Ye, G., & De Schutter, G. (2023). Prediction & optimization of alkali-activated concrete based on the random forest machine learning algorithm. *Construction and Building Materials*, 385, 131519.

[13] Liang, M., Chang, Z., Zhang, Y., **Cheng, H.**, He, S., Schlangen, E., & Šavija, B. (2023). Autogenous deformation induced-stress evolution in high-volume GGBFS concrete: Macro-scale behavior and micro-scale origin. *Construction and Building Materials*, 370, 130663.

[14] Zheng, L., **Cheng, H.**, Huo, L., & Song, G. (2019). Monitor concrete moisture level using percussion and machine learning. *Construction and Building Materials*, 229, 117077.

Conference Presentations (Oral)

07/2022 **Cheng, H.**, Zhang, F., Yang, Y., & Blom, C. K. Monitoring of repaired concrete floor in the Maastunnel using smart aggregates. In *11th International Conference on Bridge Maintenance, Safety and Management (IABMAS)*.

05/2024 **Cheng, H.**, Zhang, S., Ye, G., & Yang, Y. Monitoring precast alkali-activated (geopolymer) concrete bridge with embedded smart aggregates: methodology and validation of performance indicators. In *20th World Conference on Non-Destructive Testing (WCNDT)*.