

Yuyan Wu

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EDUCATION

Stanford University

Sept. 2022 – Jun. 2027 (expected)

Ph.D. in Civil and Environmental Engineering

Structures as Sensors Lab

Advisor: Prof. Hae Young Noh

Dissertation topic: Sensing through Interaction Traces in Environments: Physics-Informed Learning and Adaptive Sensing

University of Science and Technology of China

Sept. 2018 – Jun. 2022

B.S. in Applied Physics & Computer Science (Dual Degree)

School of the Gifted Young

RESEARCH EXPERIENCE

Human Emotion Recognition Through Footstep-Induced Floor Vibrations

Sept. 2022 – Jun. 2024

Stanford University

Advisor: Prof. Hae Young Noh

Collaborator: Prof. Gabriella M. Harari (Department of Communication, Stanford University)

- **Goal:** Develop a nonintrusive system for indoor emotion recognition based on footstep-induced floor vibrations.
- Designed emotion-sensitive features including gait-related and vibration-related features to capture the complex relationship between emotional states and footstep-induced floor vibrations.
- Developed a personalized model that assigned greater weight to training samples from individuals with gait patterns similar to those of the target participant, addressing the challenge of large between-person variation in the relationship between emotional states and gait patterns.
- Conducted a study with 20 participants and evaluated the model on 37,001 footstep samples, achieving mean absolute errors of 1.11 and 1.07 for valence and arousal estimation, respectively, on a 1–9 scale.

Human Body Weight Estimation Through Music-Induced Bed Vibrations

Sept. 2024 – Dec. 2025

Stanford University

Advisor: Prof. Hae Young Noh

Collaborators: Prof. Moon Lee and Prof. Cherelle Smith (Division of Pediatric Emergency Medicine, Department of Emergency Medicine, Stanford University)

- **Goal:** Develop a rapid, nonintrusive system for estimating the body weight of immobilized patients without patient transfer through music-induced bed vibrations.
- Developed an active vibration sensing system that estimates body weight from changes in the vibration transfer function of the bed–body system.
- Formulated the relationship between body weight and bed vibration responses through structural dynamics and embedded the derived functional form into a physics-informed neural network for data-efficient and interpretable estimation.
- Identified bed-specific, weight-sensitive frequency bands and composed soft, natural music with high energy in these bands to induce informative vibrations while satisfying clinical sound requirements.
- Conducted human-subject experiments on wooden and steel beds with 11 participants per bed, collecting 3,960 ten-second vibration signal segments and achieving a mean absolute error as low as 1.55 kg (2.37%), satisfying clinical acceptability standards.

Non-contact Mass Estimation of Static Objects Through Active Vibration Sensing

Sept. 2025 – Apr. 2026

Stanford University

Advisor: Prof. Hae Young Noh

- **Goal:** Establish a theoretical framework for non-contact mass estimation of static objects on plate-like structures through active vibration sensing.
- Modeled finite-area object–plate coupling under Kirchhoff–Love plate theory and derived how distributed added mass modifies modal inertia, natural frequencies, and vibration transfer functions of the plate structure.
- Derived a multi-frequency Cramér–Rao lower bound on mass resolution by propagating vibration noise through transfer-function spectra and identified when the physics-informed estimator attains the bound.
- Developed a joint excitation–sensor placement metric that maximizes mass sensitivity while suppressing parasitic feedthrough and measurement noise.

Seal Whisker-Inspired Sensor Design for Underwater Animal Monitoring

Sept. 2025 – Present

Stanford University

Advisor: Prof. Hae Young Noh

Collaborators: Prof. Barbara Simpson (Department of Civil and Environmental Engineering, Stanford University); Prof. Leixin Ma (School for Engineering of Matter, Transport and Energy, Arizona State University)

- **Goal:** Develop a passive sensing system for underwater animal monitoring through wake-induced vibrations in noisy background-flow environments.
- Designed a spiral-perforated whisker base that reduces structural stiffness and amplifies wake-induced vibrations through resonance coupling within target frequency bands.
- Designed a wavy whisker structure inspired by seal whisker morphology to suppress vibration responses to background flow and improve the signal-to-noise ratio for detecting animal-generated wakes.
- Conducted underwater experiments to validate fish detection based on wake-induced whisker vibrations.

Non-invasive Arterial Blood Pressure Monitoring Through Bed Vibration Sensing

Jan. 2026 – Present

Stanford University & University of Georgia

Advisor: Prof. Hae Young Noh

Collaborator: Prof. Wenzhan Song (School of Electrical and Computer Engineering, University of Georgia)

- **Goal:** Develop a non-contact method for continuous arterial blood pressure waveform monitoring from bed vibrations in clinical settings.
- Developed a physics-informed learning framework based on the Windkessel model to constrain estimated waveform shapes and improve generalizability to unseen patients without patient-specific training data.
- Designed a physics-guided postprocessing filter to reject physically implausible waveform estimates and enhance estimation reliability.
- Evaluated on ICU data from 33 patients, achieving arterial blood pressure waveform reconstruction with a mean absolute error of 7.1 mmHg.

JOURNAL PUBLICATIONS

- [1] **Wu, Y.**, Dong, Y., Vaid, S., Harari, G. M., and Noh, H. Y. EmotionVibe: Human Emotion Recognition Through Footstep-Induced Floor Vibrations [\[Link\]](#). *IEEE Transactions on Affective Computing*.
- [2] **Wu, Y.**, and Noh, H. Y. 4DRadarRBD: 4D mmWave radar-based road boundary detection in autonomous driving [\[Link\]](#). *Frontiers in Signal Processing*, 2025.
- [3] **Wu, Y.**, Zhang, J., Lee, M., Smith, C., Li, X., Senapati, A., Zhang, P., and Noh, H. Y. Human Body Weight Estimation Through Music-Induced Bed Vibrations [\[Link\]](#). *arXiv preprint*, 2025. Under review at *IEEE Transactions on Mobile Computing*.
- [4] **Wu, Y.**, and Noh, H. Y. Non-contact Mass Estimation of Static Objects on Kirchhoff–Love Plates via Active Vibration Sensing [\[Link\]](#). *SSRN preprint*, 2026. Manuscript prepared for submission to *Journal of Sound and Vibration*.
- [5] Dong, Y., **Wu, Y.**, Chang, Y.-C., Aggarwal, J., Codling, J. R., Latapie, H., Zhang, P., and Noh, H. Y. Context-aware crowd monitoring for sports games using crowd-induced floor vibrations [\[Link\]](#). *Data-Centric Engineering*, 5:e25, 2024.
- [6] Zhao, J., **Wu, Y.**, Deng, R., Xu, S., Gao, J., and Burke, A. A Survey of Autonomous Driving from a Deep Learning Perspective [\[Link\]](#). *ACM Computing Surveys*, 57(10):1–60, 2025.
- [7] Liu, J., Aggarwal, J., Hwang, D., Lee, J., **Wu, Y.**, Yin, F., Li, H., Santi, P., Sohn, H., Biondi, B., Ratti, C., and Noh, H. Y. Bridge Monitoring Using Existing Telecom Fiber-Optic Networks [\[Link\]](#). Accepted for publication in *Nature Communications*.
- [8] Dong, Y., **Wu, Y.**, Kim, S. E., Schadl, K., Rose, J., and Noh, H. Y. Modeling Foot-Floor Interactions during Walking for Normal and Abnormal Gaits [\[Link\]](#). *Journal of Engineering Mechanics*, 151(1):04024100, 2025.
- [9] Zhang, J., **Wu, Y.**, Codling, J. R., Chang, Y.-C., Gersey, J., Zhang, P., Noh, H. Y., and Dong, Y. WeVibe: Weight Change Estimation Through Audio-Induced Shelf Vibrations in Autonomous Stores [\[Link\]](#). *arXiv preprint arXiv:2502.12093*, 2025.

CONFERENCE PUBLICATIONS

- [1] **Wu, Y.**, Giridharan, S., Ma, L., and Noh, H. Y. Seal Whisker-Inspired Sensor for Amplifying Wake-Induced Vibrations in Underwater Marine Animal Monitoring [\[Link\]](#). In *The 44th IMAC, A Conference and Exposition on Structural Dynamics (IMAC-XLIV)*, 2026.

- [2] **Wu, Y.**, Zhang, J., Lee, M., Smith, C., Zhang, P., and Noh, H. Y. Body Weight Estimation through Bed Structural Vibrations [\[Link\]](#). In *Dynamics of Civil Structures, Volume 2: Proceedings of the 43rd IMAC, A Conference and Exposition on Structural Dynamics 2025*, pp. 147–156, 2025.
- [3] **Wu, Y.**, Li, X., Yin, Z., Ma, L., and Noh, H. Y. Underwater Fish Monitoring Through Vortex-Induced Vibration Sensing [\[Link\]](#). In *Proceedings of the 15th International Workshop on Structural Health Monitoring (IWSHM 2025)*, 2025.
- [4] **Wu, Y.**, Dong, Y., Vaid, S., Harari, G. M., and Noh, H. Y. Emotion Recognition Using Footstep-Induced Floor Vibration Signals [\[Link\]](#). In *Proceedings of the 14th International Workshop on Structural Health Monitoring (IWSHM 2023)*, 2023.
- [5] Dong, Y., **Wu, Y.**, Codling, J. R., Aggarwal, J., Huang, P., Ding, W., ... and Noh, H. Y. GameVibes: Vibration-based Crowd Monitoring for Sports Games through Audience-Game-Facility Association Modeling [\[Link\]](#). In *Proceedings of the 10th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (BuildSys '23)*, pp. 177–188, 2023.
- [6] Zhang, J., **Wu, Y.**, Codling, J., Gersey, J., Bannis, A., Ruiz Dominguez, C., Sun, K., and Zhang, P. Poster Abstract: On-Shelf Weight Difference Estimation Through Active Vibration Sensing [\[Link\]](#). In *Proceedings of the 23rd ACM Conference on Embedded Networked Sensor Systems (SenSys '25)*, pp. 640–641, 2025.
- [7] Dong, Y., **Wu, Y.**, and Noh, H. Y. Social Distancing Compliance Monitoring for COVID-19 Recovery Through Footstep-Induced Floor Vibrations [\[Link\]](#). In *Proceedings of the 19th ACM Conference on Embedded Networked Sensor Systems (SenSys '21)*, pp. 399–400, 2021.
- [8] Dong, Y., **Wu, Y.**, and Noh, H. Y. Detecting Gait Abnormalities in Foot-Floor Contacts During Walking Through Footstep-Induced Structural Vibrations [\[Link\]](#). *arXiv preprint arXiv:2405.13996*, 2024.

PRESENTATIONS

Conference Presentations

<i>Emotion Recognition Based on Footstep-Induced Floor Vibration Signals</i> , Engineering Mechanics Institute (EMI)	2023
<i>Emotion Recognition Based on Footstep-Induced Floor Vibration Signals</i> , International Workshop on Structural Health Monitoring (IWSHM)	2023
<i>Personalized Emotion Detection from Floor Vibrations Induced by Footsteps</i> , Engineering Mechanics Institute (EMI)	2024
<i>Human Body Weight Estimation Based on Bed Structural Vibrations</i> , IMAC	2024
<i>Human Body Weight Estimation Based on Music-Induced Bed Structural Vibrations</i> , Engineering Mechanics Institute (EMI)	2025
<i>Underwater Fish Monitoring Through Vortex-Induced Vibration Sensing</i> , International Workshop on Structural Health Monitoring (IWSHM)	2025
<i>Seal Whisker-Inspired Sensor for Amplifying Wake-Induced Vibrations in Underwater Marine Animal Monitoring</i> , IMAC	2026
<i>Design of a Seal-Whisker-Inspired Sensor for Amplifying Wake-Induced Vibrations in Underwater Animal Monitoring</i> , Engineering Mechanics Institute (EMI)	2026

Invited & Seminar Talks

Seminar Talk: *Human Body Weight Estimation Through Music-Induced Bed Vibration Signals*, Stanford CEE Student Summer Seminar Series

Seminar Talk: *Seal Whisker-Inspired Sensor for Amplifying Wake-Induced Vibrations in Underwater Marine Animal Monitoring*, Italian National Research Council, Institute of Marine Engineering (INM), Rome

Invited Seminar Talk: *Seal Whisker-Inspired Sensor for Amplifying Wake-Induced Vibrations in Underwater Marine Animal Monitoring*, University of Florence

Posters & Demos

Poster: <i>EmotionVibes: Emotion Recognition Using Footstep-Induced Floor Vibrations</i> , eWEAR Annual Meeting Symposium	2024
Poster: <i>Human Body Weight Estimation Based on Music-Induced Bed Vibrations</i> , Blume Center 50th Anniversary Celebration	2025
Demo: <i>Human Body Weight Estimation Based on Music-Induced Bed Vibrations</i> , Stanford Engineering Centennial Celebration and Showcase	2025
Demo: <i>Weight Estimation Through Active Structural Vibration Sensing</i> , SHM in Action, 15th International Workshop on Structural Health Monitoring (IWSHM)	2025

TEACHING & MENTORING

Head Teaching Assistant, CEE 154/254: Data Analytics for Physical Systems
Stanford University

Winter 2026

- Served as Head Teaching Assistant for the combined undergraduate- and graduate-level course.

Instructional Support and Project Mentor, CEE 286: Structural Monitoring
Stanford University

Winter 2025; Spring 2026

- Facilitated in-class discussions and mentored students on their course projects throughout both offerings.

Research Mentoring

Xinyi Li M.S. student, Stanford University. Coauthored one conference paper and one preprint submitted for journal publication; incoming Ph.D. student at Georgia Institute of Technology.

Adem Taiyr Ph.D. student, Stanford University.

Zexi Yin M.S. student, Stanford University. Coauthored one conference paper.

Ankur Senapati B.S. student, Purdue University; mentored as a summer research intern. Coauthored one paper.

Varun Sahay M.S. student, Stanford University.

ACADEMIC AND PROFESSIONAL SERVICE

Student Representative, CEE Faculty Search Committee

Student Volunteer, 4th International Workshop on Human-Centered Sensing, Modeling, and Intelligent Systems (HumanSys 2026), co-located with ACM MobiCom 2026

Committee Member and Reviewer, International Workshop on Structural Health Monitoring (IWSHM), 2023

Reviewer, *Scientific Reports*

FELLOWSHIPS AND SPONSORED RESEARCH

Stanford Blume Fellowship 2024–2025

Stanford CEE Ph.D. Fellowship 2022–2024

Graduate Researcher, *SEA-Scan: Structural and Environmental Algorithms for Sensing of Offshore Systems*, California Energy Commission–funded project 2026–Present

HONORS AND AWARDS

Guo Moruo Scholarship — USTC's highest undergraduate honor (top 1%) 2021

Huawei Scholarship — awarded to the top 5% of students 2020

National Scholarship — awarded to the top 3% of students 2019