

YUNFENG ZHANG

Professor

Department of Civil and Environmental Engineering, University of Maryland

College Park, MD 20742

Tel: (301) 405-1955; E-mail: zyf at umd dot edu

BIOSKETCH

Dr. Yunfeng Zhang has been a Professor in the Department of Civil and Environmental Engineering since 2008. He received his PhD degree from the California Institute of Technology in 2001. His research experiences include resilience study of bridges and buildings, field testing of bridges, modal testing, non-destructive evaluation (NDE) of pavement and bridge structures, information technology for highway datasets including machine learning and sensor data compression, sensor technology and data analytics technology. For his work in infrastructure data analysis and computing technology, Dr. Zhang received the Best Paper Award from the ASCE Journal of Computing in Civil Engineering in 2006. He is also the receiver of an NSF CAREER Award for interdisciplinary research in information technology and structural health monitoring. He has done research work in data analytics for highway datasets, as well as integrating deep learning algorithms with bridge condition rating prediction using national bridge inventory datasets. He is familiar with cleaning, filtering, and extracting data techniques for database. Dr. Zhang has done work in integrating deep learning algorithms with bridge/pavement condition and embankment/cut slope landslide risk assessment using NBI data and other types of highway datasets such as SPT data and drilling project duration/finance. Educated in Civil Engineering, he also understands general material testing and traffic operations. Dr. Zhang has done extensive work in deep learning to highway infrastructures and currently working on a research project on machine learning for highway datasets sponsored by Maryland DOT (MDOT).

EDUCATION

Ph.D. in Applied Mechanics, California Institute of Technology, 2001

M.S. in Civil Engineering (Structures), Tsinghua University (Beijing, China), 1996

B.S. in Civil Engineering (Structures), Tongji University (Shanghai, China), 1993

PROFESSIONAL APPOINTMENTS

Professor (tenured), University of Maryland, August 2014 - present

Research interests are: deep learning, self-centering modular panels, self-centering eccentrically braced frame structures, sensor technology (bio-inspired sensors and 3d printable sensing materials, sensor performance degradation, piezoelectric film acoustic emission sensor, RFID sensor for buckling and yielding detection), smart materials (piezoelectric paint and shape memory alloy), structural health monitoring and infrastructure management (integration of SHM and BIM for automated condition assessment and infrastructure management, structural health prognosis for fatigue and corrosion, wireless sensor network), nonlinear fuse elements and resilience enhancement technologies for steel structures (self-centering diagrid structures with fuse members); large scale structural testing and hybrid simulation technique.

Associate Professor (tenured), University of Maryland, January 2008 – August 2014

Associate Professor (tenured), Lehigh University, 2007 – January 2008

Assistant Professor, Lehigh University, 2001 - 2007

HONORS AND AWARDS

Graduate Research Board Award, University of Maryland, 2008

Best Paper Award, ASCE Journal of Computing in Civil Engineering, 2006

NSF CAREER Award, 2006

PUBLICATIONS: REFEREED JOURNALS

- 1) Rezvan, P. and **Zhang, Y.** (2022). "Nonlinear seismic performance study of D-type self-centering eccentric braced frames with sliding rocking link beams," *Earthquake Engineering and Structural Dynamics*, 51(4): 875 - 895.
- 2) Chu, G., Wang, W. and Zhang, Y. (2022). "Experimental and Numerical Study of Near-Fault Seismic Performance of 2-Story Steel Framed Building with Self-Centering Modular Panels," *ASCE J. Structural Engrg.*, 148(6).
- 3) Liu, H. and **Zhang, Y.** (2020). "Deep Learning based Crack Damage Detection Technique for Thin Plate Structures using Guided Lamb Wave Signals," *Smart Materials and Structures*, 29(1): 015032.
- 4) Liu, H. and **Zhang, Y.** (2020). "Bridge Condition Rating Data Modeling using Deep Learning Algorithm," *Structure and Infrastructure Engineering*, 16(10): 1447-1460, <https://doi.org/10.1080/15732479.2020.1712610>
- 5) Liu, H. and **Zhang, Y.** (2019). "Deep learning based brace damage detection for concentrically braced frame structures under seismic loadings," *Advances in Structural Engineering*, <https://doi.org/10.1177/1369433219859389>.
- 6) Keivan, A. and **Zhang, Y.** (2019). "Seismic performance evaluation of self-centering K-type and D-type steel eccentrically braced frame systems," *Engineering Structures*, 184: 301-317.
- 7) Tang, Y., Wu, G., Sun, Z., Zhang, Y. (2019). "Seismic performance of underwater bridge columns strengthened with prestressed precast concrete panels and embedded FRP reinforcement," *ASCE J. Composite Structures*, 23(3): [https://doi.org/10.1061/\(ASCE\)CC.1943-5614.0000948](https://doi.org/10.1061/(ASCE)CC.1943-5614.0000948).
- 8) **Zhang, Y.** and Liu, H. (2019). "Experimental study of vibration mitigation of mast arm signal structures with particle-thrust damping based tuned mass damper." *Earthquake Engineering and Engineering Vibration*, 18(1): 219-231.
- 9) Keivan, A. and **Zhang, Y.** (2019). "Nonlinear seismic performance of Y-type self-centering steel eccentrically braced frame buildings," *Engineering Structures*, 179: 448-459.
- 10) Tong, L, **Zhang, Y.** Zhou X, Keivan A, Li R. (2019). "Experimental and analytical investigation of D-type self-centering steel eccentrically braced frames with replaceable hysteretic damper," *ASCE J Structural Engrg*, 145(1): 04018229.
- 11) Liu, H. and **Zhang, Y.** (2019). "Image-driven structural steel damage condition assessment method using deep learning algorithm." *Measurement*, 133: 168-181.

- 12) Tong, L., **Zhang, Y.**, Zhang, L., Liu, H., Zhang, Z., and Li, R. (2018). "Ductility and energy dissipation behavior of G20Mn5QT cast steel shear link beams under cyclic loading." *Journal of Constructional Steel Research*, 149: 64-77.
- 13) Wang, Z., **Zhang, Y.**, Wang, Y., Du, X. and Yuan, H. (2018). "Numerical study on fatigue behavior of tubular joints for signal support structures," *J. Construction Steel Research*, 143: 1-10.
- 14) Wang, W., Kong J., **Zhang, Y.**, Chu G. and Chen, Y. (2017). "Seismic behavior of self-centering modular panel with slit steel plate shear walls: experimental testing," *ASCE J. Structural Engrg.*, 144(1).
- 15) Wang, W., Du, X., **Zhang, Y.** and Chen, Y. (2017). "Experimental Investigation of beam-through steel frames with self-centering modular panels," *ASCE J. Structural Engrg.*, 143(5).
- 16) Xu, X., Zhang, Y. and Luo, Y. (2016). "Self-centering eccentrically braced frames using shape memory alloy bolts and post-tensioned tendons," *J. Constructional Steel Research*, 125: 190–204.
- 17) Wang, W., Zou, C., Chen, Y., Zhang, Y. and Chen, Y. (2016). "Seismic design of multistory tension-only concentrically braced beam-through frames aimed at uniform inter-story drift," *J. Constructional Steel Research*, 122: 326- 338.
- 18) Zhang, Y. (2016). "Smart sensing technology for large-scale structural systems," *International Journal of Terraspace Science and Engineering*, 8(1).
- 19) Xu, X., **Zhang, Y.** and Luo, Y. (2016). "Self-centering modularized link beams with post-tensioned shape memory alloy rods," *Engineering Structures*, 112: 47–59.
- 20) **Zhang, Y.** and Bai, L. (2015). "Rapid structural condition assessment using radio frequency identification (RFID) based wireless strain sensor," *Automation in Construction*, 54: 1-11.
- 21) **Zhang, Y.**, Shi, F., Song, J., Zhang, X., Yu, S. (2015). "Hearing characteristics of Cephalopods: modeling and environmental impact study," *Integrative Zoology*, 10: 141-151.
- 22) Li, R., **Zhang, Y.** and Tong, L.W. (2014). "Numerical study of the cyclic load behavior of AISI 316l stainless steel shear links for seismic fuse device," *Frontiers of Structural and Civil Engineering*, 8(4): 414-426.
- 23) Gu, M., Tong, L.W., Zhao, X.L. and Zhang, Y.F. (2014), "Numerical analysis of fatigue behavior of welded CFCHS T-joints," *Advanced Steel Construction*, 10(4): 476-497.
- 24) Li, Z. and **Zhang, Y.** (2014). "Fatigue life prognosis study of welded tubular joints in signal support structures," *International Journal of Steel Structures*, 14(2): 281-292.
- 25) Zhou, C. and **Zhang, Y.** (2014). "Acoustic emission source localization using coupled piezoelectric film strain sensors" *J. of Intelligent Material System and Structures*, 25(16): 2082-2092.
- 26) Zhou, C. and **Zhang, Y.** (2014). "Near-field acoustic emission sensing performance of piezoelectric film strain sensor," *Research in Nondestructive Evaluation*, 25(1): 1-19. (DOI:10.1080/09349847.2013.810318)
- 27) Li, Z. and **Zhang, Y.** (2014). "Extreme value theory based structural health prognosis method using reduced sensor data," *Structures and Infrastructure Engineering*, 10(8): 988-997. DOI: 10.1080/15732479.2013.774427.
- 28) Hu, X., and **Zhang, Y.** (2013). "Ductility demand of partially self-centering structures under seismic loading: SDOF systems," *Journal of Earthquake and Structures*, 4(4), 365-381.

- 29) Moghaddasi B, N.S. and **Zhang, Y.** (2013). “Seismic analysis of diagrid structural frames with shear-link fuse devices,” *Earthquake Engineering and Engineering Vibration*, 12(3), 463-472.
- 30) Zhu, S. and Zhang, Y. (2013). “Loading rate effect on superelastic SMA-based seismic response modification devices,” *Journal of Earthquake and Structures*, 4(6), 607-627.
- 31) Bai, L. and **Zhang, Y.** (2013). “Nonlinear dynamic behavior of steel framed roof structure with self-centering members under transient wind loading,” *Engineering Structures*, 49(4): 819–830.
- 32) Li, Z., **Zhang, Y.** and Wang, C. (2013). “A sensor-driven structural health prognosis procedure considering sensor performance degradation,” *Structures and Infrastructure Engineering*, 9(8): 764-776. DOI: 10.1080/15732479.2011.614259.
- 33) Hu, X., **Zhang, Y.** and Moghaddasi, N. (2012). “Seismic performance of reinforced concrete frames retrofitted with self-centering hybrid wall,” *Advances in Structural Engineering*, 15(12): 2139-2151.
- 34) Tong, L., Xian, Q., Zhou, L., Chen, Y. and Zhang, Y. (2012). “Experimental investigation on fatigue behavior of steel reinforced concrete composite beam-to-girder joints,” *International Journal of Steel Structures*, 12(4): 461-472.
- 35) Bai, L. and **Zhang, Y.** (2012). “Collapse fragility assessment of steel roof framings with force limiting devices under transient wind loading,” *Frontiers of Structural and Civil Engineering*, 6(3): 199-209. DOI: 10.1007/s11709-012-0168-4.
- 36) Moghaddasi B, N.S., **Zhang, Y.** and Hu, X. (2012). “Seismic retrofitting of reinforced concrete frame structures using GFRP-tube-confined-concrete composite braces,” *Earthquake Engineering and Engineering Vibration*, 11(1): 91-105.
- 37) Mercado, M. and **Zhang, Y.** (2012). “A hybrid simulation testbed for realistic evaluation and characterization of NDE and sensor technology,” *Journal of Bridge Engineering*, 17(6): 907-920.
- 38) Zhou, C. and **Zhang, Y.** (2012). “Particle filter based noise removal method for acoustic emission signals,” *Mechanical Systems and Signal Processing*, 28(1-2): 63–77.
- 39) Liu, J., Zhu, S., Xu, Y.L. and Zhang, Y. (2011). “Displacement-based design approach for highway bridges with SMA isolators,” *Smart Structures and Systems*, 8(2): 173-190.
- 40) Yoo, B., Purekar, A.S., Zhang, Y. and Pines, D.J. (2010). “Piezoelectric-paint-based two-dimensional phased sensor arrays for structural health monitoring of thin panels,” *Smart Material and Structures*, **19** 075017.
- 41) **Zhang, Y.** and Hu, X. (2010). “Self-centering seismic retrofit scheme for reinforced concrete frame structures: SDOF system study,” *Earthquake Engineering and Engineering Vibration*, 9(2): 271-283. DOI 10.1007/s11803-010-0012-6.
- 42) Li, X. and **Zhang, Y.** (2010). “A constitutive model for piezoelectric paint with mixed connectivity,” *Journal of Intelligent Material Systems & Structures*, 21(12): 1213-1225.
- 43) **Zhang, Y.**, Hu, X. and Zhu, S. (2009). “Seismic performance of benchmark base isolated bridges with superelastic Cu-Al-Be wire damper,” *Structural Control and Health Monitoring*, 16: 668-685.
- 44) Li, X. and **Zhang, Y.** (2008). “Analytical study of piezoelectric paint sensor for acoustic emission based fracture monitoring,” *Fatigue & Fracture of Engineering Materials & Structures*, 31(8): 684-694.
- 45) Li, X. and **Zhang, Y.** (2008). “Feasibility study of wide-band low-profile ultrasonic sensor with flexible piezoelectric paint,” *Smart Structures and Systems*, 4(5): 565-582.

- 46) **Zhang, Y.**, Camilleri, J.A. and Zhu, S. (2008). "Mechanical properties of superelastic Cu-Al-Be wire at cold temperatures for the seismic protection of bridges," *Smart Materials and Structures*, 17: 025008.
- 47) Li, J., **Zhang, Y.**, and Zhu, S. (2008). "A Wavelet-based structural damage assessment approach with progressively downloaded sensor data," *Smart Materials and Structures*, 17: 015-020.
- 48) Zhu, S. and **Zhang, Y.** (2008). "Seismic analysis of concentrically braced frame systems with self-centering friction damping braces," *ASCE Journal of Structural Engineering*, 134(1): 121-131.
- 49) **Zhang, Y.** and Lu, L.-W. (2008). "Introducing smart structures technology into civil engineering curriculum: education development at Lehigh University," *ASCE Journal of Professional Issues in Engineering Education and Practice*, 134(1): 41-48.
- 50) **Zhang, Y.**, and Zhu, S. (2008). "Seismic response control of building structures with superelastic Shape Memory Alloy wire damper," *ASCE Journal of Engineering Mechanics*, 134(3): 240-251.
- 51) **Zhang, Y.** and Zhu, S. (2007). "Shape memory alloy-based reusable hysteretic damper for seismic hazard mitigation," *Smart Materials and Structures*, 16: 1603- 1613.
- 52) Zhu, S. and **Zhang, Y.** (2007). "A thermomechanical constitutive model for superelastic SMA wire with strain-rate dependency," *Smart Materials and Structures*, 16: 1696- 1707.
- 53) Zhu, S. and **Zhang, Y.** (2006). "Seismic behavior of self-centering braced frame buildings with reusable hysteretic damping brace," *Earthquake Engineering and Structural Dynamics*, 36: 1329-1346.
- 54) **Zhang, Y.**, and Li, J. (2006). "Linear predictor-based lossless compression of vibration sensor data: a systems approach," *ASCE Journal of Engineering Mechanics*, 133(4): 431-441.
- 55) Li, J., and **Zhang, Y.** (2006). "Interactive sensor network data retrieval and management using PCA transform," *Smart Materials and Structures*, 15: 1747-1757.
- 56) **Zhang, Y.**, and Li, J. (2006). "A wavelet-based sensor data compression technique for civil infrastructure condition monitoring," *ASCE Journal of Computing in Civil Engineering*, 20(6): 390-399.
- 57) Li, J., and **Zhang, Y.** (2005). "Prediction error method-based second-order structural identification algorithm in stochastic state space formulation," *Earthquake Engineering and Structural Dynamics*, 35: 761-779.
- 58) **Zhang, Y.**, and Li, J. (2005). "Efficient seismic response data storage and transmission using ARX model-based sensor data compression algorithm," *Earthquake Engineering and Structural Dynamics*, 35: 781-788.
- 59) **Zhang, Y.** (2006). "In-situ fatigue crack detection using piezoelectric paint sensor," *Journal of Intelligent Material Systems and Structures*, 17(10): 843-852.
- 60) **Zhang, Y.**, and Li, J. (2005). "DPCM-based vibration sensor data compression and its effect on structural system identification," *Earthquake Engineering and Engineering Vibration*, 4(1): 153-163.
- 61) **Zhang, Y.**, Sause, R. Ricles, J. M., and Naito, C. J. (2004). "Modified predictor-corrector numerical scheme for real-time pseudo-dynamic test using state-space formulation," *Earthquake Engineering and Structural Dynamics*, 34: 271-288.
- 62) **Zhang, Y.** (2003). "The Concept and Development of Smart Structures Technology for Long-span Cable-supported Bridges," *Marine Georesources & Geotechnology*, 21: 315-331.

- 63) **Zhang, Y.** and Iwan, W. D. (2003). “Statistical performance analysis of seismic-excited structures with active interaction control,” *Earthquake Engineering and Structural Dynamics*, 32: 1039-1054.
- 64) **Zhang, Y.** and Iwan, W. D. (2003) “Some observations on two piecewise-linear dynamic systems with induced hysteretic damping,” *International Journal of Nonlinear Mechanics*, 38: 753-765.
- 65) **Zhang, Y.** and Iwan, W. D. (2002). “Active interaction control of civil structures. Part 1: SDOF systems,” *Earthquake Engineering and Structural Dynamics*, 31: 161-178.
- 66) **Zhang, Y.** and Iwan, W. D. (2002). “Active interaction control of civil structures. Part 2: MDOF systems,” *Earthquake Engineering and Structural Dynamics*, 31: 179-194.
- 67) **Zhang, Y.** and Iwan, W. D. (2002). “Active interaction control of tall buildings subjected to near-field ground motions,” *ASCE Journal of Structural Engineering*, 128(1): 69-79.
- 68) **Zhang, Y.** and Iwan, W. D. (2002). “Protecting base-isolated structures from near-field ground motion by tuned interaction damper,” *ASCE Journal of Engineering Mechanics*, 128(3): 287-295.
- 69) **Zhang, Y.** and Wang, Z. (2000). “Seismic behavior of reinforced concrete shear-walls subjected to high axial loading,” *ACI Structural Journal*, 97(5): 739-750.

PUBLICATIONS: BOOK EDITED

Proceedings of the US-Korea Workshop on Bio-inspired Sensor Technology and Infrastructure Monitoring, edited by C. Yun, **Y. Zhang**, A. Flatau, H.-J. Jung, Techno Press, ISBN: 978-89-89693-25-3,

PUBLICATIONS: CHAPTERS IN BOOKS

Zhang, Y., Ayyub, B., & Huang, H. (2018). Chapter 1 on Enhancing Civil Infrastructure Resilience with Structural Health Monitoring. *Resilience Engineering for Urban Tunnels*, ASCE, Reston, Virginia.

Zhang, Y. (2009). “Piezoelectric paint sensors for ultrasonics based damage detection”, *Encyclopedia of Structural Health Monitoring*, Boller, Christian / Chang, Fu-Kuo / Fujino, Yozo (eds.), John Wiley & Sons Ltd, Chichester, UK. ISBN-10: 0-470-05822-6.

Zhang, Y. and Zhu, S. (2009). “Seismic resistant braced frame structures with shape memory alloy-based self-centering damping device,” *Earthquake Engineering: New Research*, T. Miura and Y. Ikeda (eds), Nova Science Publishers, Inc., Hauppauge, NY. pp. 219-254. ISBN: 978-1-60876-556-0.

CURRENT RESEARCH PROJECT

- Effectively Implementing Machine Learning with Office of Materials Technology, Phase 2 — MDOT SHA, 2021-2023. Principal Investigator. In this project, Dr. Zhang’s team will implement recent advance in machine learning methods including neural nets, reinforcement learning and computer vision methods. Newer and more powerful machine learning models not available in previous applications and research in highway transportation fields will be investigated to address the challenging needs identified by MDOT SHA in design and construction, materials test data, management, operating optimization and field inspection.

TEACHING AND RESEARCH ADVISING

ENCE353 Introduction to Structural Analysis (S 2008, F 2009, F 2010);

ENCE201 Engineering Information Processing II (S 2010, S 2011, S2012);
ENCE444 Experimental Methods in Geotechnical and Structural Engineering (F 2011, S2012 – F2019)
ENES220 Mechanics of Materials (F 2008, S 2009);
ENCE710 Steel Structures Design (S 2022)
ENCE715 Earthquake Engineering (S 2009, S 2011, S 2014 -S2021);
ENCE688W Experimental Methods in Structural Engineering (F 2009);
ENCE613 Structural Dynamics (S 2010, S 2012 - F 2022);
ENCE688A Sensing and System Control (F 2010, F 2011);

Doctoral Student Supervised

- 1) Jian Li, 2002 - 2006 (graduated in December 2006), current position: Senior Engineer and division director, Guangdong Provincial Academy of Building Research, Guangzhou, China
- 2) Songye Zhu, 2003 - 2007 (graduated in December 2007), current position: Professor, Hong Kong Polytechnic University (started in April 2008)
- 3) Xin Li, 2005 – 2009 (graduated in May 2009), current position: Project Engineer, HNTB, Wayne, NJ.
- 4) Nasim B. Moghaddasi, 2008 – 2011, current position: Project Manager, WSP USA, New York City.
- 5) Zhen Li, 2008 - 2013 (graduated in May 2013), current position: Data scientist, Megaputer Intelligence Inc, Bloomington, Indiana.
- 6) Changjiang Zhou, 2008 - 2013 (graduated in May 2013), current position: Senior Structural Engineer, BMC Engineering LLC, Boston, MA.
- 7) Linjia Bai, 2009 – 2013 (graduated in December 2013), current position: Structural Engineer, Maryland State Highway Administration, Baltimore, MD.
- 8) Feng Shi, 2011 – 2015 (graduated in May 2015), current position: Structural Engineer, iDesign, Silver Spring, Maryland
- 9) Noah Blum, 2010 – 2015 (graduated in May 2015), current position: Structural Engineer, Jacobs, Baltimore, MD; won Dwight Eisenhower Graduate Fellowship from US DOT in April 2012; won the 2011-2012 Distinguished Teaching Assistant of University of Maryland.
- 10) Ruipeng Li, 2012 – 2015 (graduated in December 2015), current position: Structural Engineer, Louis Berger, Chantilly, VA.
- 11) Arshia Keivan Esfahani, 2014 – 2018 (graduated in December 2018), current position: Structural Engineer, Saiful bouquet Structural Engineers, Pasadena, CA.
- 12) Heng Liu, 2014 – 2018 (graduated in December 2018), current position: FHWA NDE Lab
- 13) Pooya Rezvan, 2019-present
- 14) Jianshu Xu, 2020 – present
- 15) Ahmet Darilmaz, 2021 – present
- 16) Amirhossein Eskandarinadaf, 2021 – present