

Yisheng Zheng

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Education

- Sep. 2013-Jun.2019

Ph.D student, Aerospace Engineering, Xi'an Jiaotong University, China

Dissertation: Harnessing Negative Stiffness for Low-frequency Isolator and Nonreciprocal Metastructure.

- Dec. 2016-Dec. 2018

Visiting Ph.D student by China Scholarship Council, Mechanical Engineering, University of Michigan, Ann Arbor, USA

- Sept.2009-Jul.2013

Bachelor of Engineering, Aircraft Design and Engineering, Xi'an Jiaotong University, China

Research Interests

- ✧ Dynamic systems utilizing negative-stiffness structure or bistable structure for vibration control, wave propagation and robotic functionalities.
- ✧ Acoustic/elastic metamaterials for manipulating wave propagation properties, such as bandgap, nonreciprocity and acoustic black hole.
- ✧ Smart structures/materials such as magnetic systems and piezoelectric systems.
- ✧ Exploring the benefits (new functionalities, better performance, breaking limitations et al.) of nonlinear properties in dynamic systems.

Research Experience

Piezo-metamaterials shunted with nonlinear circuits and high-order circuits

Jan. 2019 – Jun. 2019, PhD student in Xi'an Jiaotong University

- Explored wave propagation properties of 1D/2D piezo-metamaterials shunted with nonlinear circuits and high-order circuits (ongoing project)

Bistable metastructures for nonreciprocal wave transmission

Dec. 2016 – Dec. 2018, Visiting PhD student in University of Michigan, Ann Arbor

- Designed and manufactured a magneto-elastic bistable metastructure; tested its

nonreciprocal wave transmission property in cooperation with my lab mate.

- Designed a bistable circuit and studied its static and dynamic properties.
- Investigated a piezo-metamaterial shunted with bistable circuits for nonreciprocal wave transmission.

Low-frequency vibration isolators utilizing negative-stiffness magnetic springs

Sep. 2013 – Nov. 2016, PhD student in Xi'an Jiaotong University

- Proposed a magnetic spring with negative stiffness in the translational direction and then studied a SDOF vibration isolator based on this magnetic spring.
- Designed a magnetic spring with torsional negative stiffness and then utilized it to realize a quasi-zero stiffness coupling.
- Investigated a Stewart isolation platform based on the negative stiffness magnetic spring, which can achieve low-frequency isolation performance in six directions.

Electromagnetic shunt damping for multi-mode vibration suppression

Jan. 2013 – June. 2013, Undergraduate student in Xi'an Jiaotong University

- Studied a circuit with negative resistance and the mechanism of electromagnetic shunt damping using this circuit.
- Investigated the vibration suppression performance of a plate with electromagnetic shunt damping

Designed a small flapping-wing air vehicle with a group of classmates.

Sep. 2012 – Dec. 2012, Undergraduate student in Xi'an Jiaotong University

Publications

Journal papers

- [1] **Y. Zheng**, Z. Wu, X. Zhang, K.W. Wang. A piezo-metastable structure with bistable circuit shunts for adaptive nonreciprocal wave transmission. *Smart Mater. Struct.* 28 (2019) 045005. <https://doi.org/10.1088/1361-665X/ab083c>
- [2] Z. Wu, **Y. Zheng**, K.W. Wang, Metastable modular metastructures for on-demand reconfiguration of band structures and non-reciprocal wave propagation, *Phys. Rev. E.* 97 (2018) 022209. <https://doi.org/10.1103/physreve.97.022209>
- [3] **Y. Zheng**, Q. Li, B. Yan, Y. Luo, X. Zhang, A Stewart isolator with high-static-low-dynamic stiffness struts based on negative stiffness magnetic springs, *J. Sound Vib.* 422 (2018) 390–408. <https://doi.org/10.1016/j.jsv.2018.02.046>
- [4] **Y. Zheng**, X. Zhang, Y. Luo, Y. Zhang, S. Xie, Analytical study of a quasi-zero stiffness coupling using a torsion magnetic spring with negative stiffness, *Mech. Syst. Signal Process.* 100 (2018) 135–151. <https://doi.org/10.1016/j.ymsp.2017.07.028>
- [5] **Y. Zheng**, X. Zhang, Y. Luo, B. Yan, C. Ma, Design and experiment of a

high-static-low-dynamic stiffness isolator using a negative stiffness magnetic spring, *J. Sound Vib.* 360 (2016) 31–52. <https://doi.org/10.1016/j.jsv.2015.09.019>

[6] **Y. Zheng**, X. Zhang, C. Ma, Z. Zhang, S. Zhang, An ultra-low frequency pendulum isolator using a negative stiffness magnetic spring, *Int. J. Appl. Electromagn. Mech.* 52 (2016) 1313–1320. <https://doi.org/10.3233/JAE-162161>

Conference papers

[1] **Y. Zheng**, Z. Wu, X. Zhang, K.W. Wang, A piezoelectric metamaterial with bistable circuit Shunts for adaptive non-reciprocal elastic wave transmission, in: *ASME 2018 Conf. Smart Mater. Adapt. Struct. Intell. Syst.*, American Society of Mechanical Engineers, San Antonio, USA, 2018: p. V001T03A003.

<https://doi.org/10.1115/SMASIS2018-7924>

[2] N. Kidambi, **Y. Zheng**, K.W. Wang, R.L. Harne, Energy release for the actuation and deployment of muscle-inspired asymmetrically multistable chains, in: *Act. Passiv. Smart Struct. Integr. Syst. XII*, International Society for Optics and Photonics, Denver, USA, 2018: p. 1059510. <https://doi.org/10.1117/12.2296583>

[3] **Y. Zheng**, X. Zhang, S. Xie, Y. Zhang, Theoretical and experimental study of a vibration isolator using a negative stiffness magnetic spring, in: *24th Int. Conf. Sound Vib.*, London, UK, 2017.

Scholarships & awards

2018, National Scholarship, Xi'an Jiaotong University

2016, Scholarship from China Scholarship Council for doing research in the University of Michigan, Ann Arbor as a Visiting PhD student

2012, Siyuan Scholarship, Xi'an Jiaotong University

2011, National Scholarship, Xi'an Jiaotong University

2011, Third Prize of the Eightieth National Zhou Peiyuan Mechanics contest, China

2010, National Encouragement Scholarship, Xi'an Jiaotong University

2007, First Prize in the Twenty-Fourth National High School Student Contest of Physics in the area of Jiangxi Province, China