Shaoyun Wang

573-489-9584 | shaoyunwang@missouri.edu | Google Scholar | Website

Education

University of Missouri — Columbia, MO
PhD, Mechanical Engineering — Expected Jul. 2025
Dissertation: "Wave propagation in elastic time-varying media"

Ningbo University — Ningbo, China
MS, Theoretical Physics — Sep. 2016 – Jun. 2019
Dissertation: "Simulation of mixing charged brushes under external electric fields"

Ningbo University — Ningbo, China
BS, Engineering Mechanics — Sep. 2012 – Jun. 2016

Research Experience

University of Missouri — Jan. 2020 – Present

Wave propagation in time-varying media (Prof. Guoliang Huang)
- Utilize the WKB method to develop ray theory for wave propagation in time-varying media
- Observe temporal refraction and reflection of flexural waves
- Establish the Chern number of k-bands and design a platform to observe temporal edge modes
- Develop adiabatic theory and design structures for observing topological pumping of surface waves

Non-Hermitian and topological physics (Prof. Guoliang Huang and Emil Prodan)
- Design active metamaterials to achieve odd mass density
- Develop theoretical frameworks of topological mode and skin mode in non-Hermitian lattices
- Design elastic structures to observe spectral flow with Frieze Group symmetries

Developing homogenization theory for lattice and active Materials (Prof. Guoliang Huang)
- Formulate source-driven homogenization for active non-Hermitian Willis metabeams
- Develop the homogenization theory of lattice material through micro-inertia media
- Create a 2D microtwist theory for modeling hinged Kagome lattices

Use FEA to study multiphysics fields of soft materials and electronics (Prof. Zheng Yan and Jian Lin)
- Simulate large deformation, contact interactions, thermal-flow couplings, and multi-phase flow dynamics

Ningbo University — 2016 – 2019

Molecular dynamics and Monte Carlo simulation of charged brushes (Prof. Chaohui Tong)
- Develop comprehensive MD and MC programs in Fortran, each consisting of nearly 5000 lines of code
- Develop a cell list algorithm for MC simulation, incorporating particle creation and annihilation

Mindlin plate theory with temperature biasing field (Prof. Ji Wang)
- Identify optimal quartz cuts for stable temperature performance
- Investigate the aging behavior of quartz resonators

Teaching Experience

Teaching Assistant, University of Missouri

MAE 3100: Computational methods for engineering design (Prof. Hussein Nassar) — 2022 – 2024
- Lead interactive MATLAB coding, using coding examples and whiteboard to explain complex concepts.
- Assist students in completing programming projects, providing guidance and code reviews.
- Facilitate Q&A sessions to address student queries and reinforce their understanding of course material.

MAE 4990: Undergraduate research in mechanical and aerospace engineering (Prof. Michael Poehlman) — 2021
- Guide students in conducting research projects, providing advice and answering questions.

Undergraduate Capstone Project Advisor, University of Missouri

Designing jumping shoes by using lattice structures (Prof. Guoliang Huang) — Spring 2021
- Provide theoretical advising on designing principle and guide students in mathematical modeling.
- Assist in building CAD models, conducting FEA simulations, and validating designs by MTS and DIC systems.

Selected Publications

Wang, S., & Huang, G. A source-driven homogenization of active non-Hermitian Willis metabeam. In preparation.

Wang, S., Zhu, R., & Huang, G. Micro-inertia Continuum Modeling of Macroscopic Behavior of Elastic Metamaterials with Microstructures. In preparation.

Wang, S., Shao, N., Chen, H., Chen, J., Qian, H., Wu, Q., & Huang, G. Temporal refraction and reflection in modulated mechanical metabeams: theory and physical observation. To be submitted.

Wu, Q., **Wang, S.**, Qian, H., Wang, Y., & Huang, G. (2024). Understanding of topological mode and skin mode morphing in 1D and 2D non-Hermitian resonance-based meta-lattices. Journal of the Mechanics and Physics of Solids, 105907. PDF

Zhao, G., Chen, Z., **Wang, S.**, Chen, S., Zhang, F., Andrabi, S. M., ... & Yan, Z. (2024). Sustainable Nanofibril Interfaces for Strain-Resilient and Multimodal Porous Bioelectronics. Advanced Materials, 2411587. PDF

Lux, F. R., Stoiber, T., **Wang, S.**, Huang, G., & Prodan, E. (2024). Topological spectral bands with frieze groups. Journal of Mathematical Physics, 65(6). PDF

Zheng, B., Xie, Y., Xu, S., Meng, A. C., **Wang, S.**, ... & Lin, J. (2024). Programmed multimaterial assembly by synergized 3D printing and freeform laser induction. Nature Communications, 15(1), 4541. PDF

Wang, S., Hu, Z., Wu, Q., Chen, H., Prodan, E., Zhu, R., & Huang, G. (2023). Smart patterning for topological pumping of elastic surface waves. Science Advances, 9(30), eadh4310. PDF

Wu, Q., Xu, X., Qian, H., **Wang, S.**, Zhu, R., Yan, Z., ... & Huang, G. (2023). Active metamaterials for realizing odd mass density. Proceedings of the National Academy of Sciences, 120(21), e2209829120. PDF

Chen, H., **Wang, S.**, Li, X., & Huang, G. (2022). Two-dimensional microtwist modeling of topological polarization in Kagome lattices and its experimental validation. International Journal of Solids and Structures, 254, 111891. PDF

Wang, S., & Tong, C. (2020). Surface switching of mixed polyelectrolyte brushes made of 4-arm stars and linear chains: MD simulations. Journal of Applied Physics, 127(7). (Editor's pick) PDF

Xie, L., **Wang, S.**, Ding, J., Banerjee, J. R., & Wang, J. (2020). An accurate beam theory and its first-order approximation in free vibration analysis. Journal of Sound and Vibration, 485, 115567. PDF

Zhang, F., **Wang, S.**, Ding, H., & Tong, C. (2019). Simulations of 3-arm polyelectrolyte star brushes under external electric fields. Soft Matter, 15(12), 2560-2570. (Back cover) PDF

Awards & Achievements

Second Place in the ASME Noise Control and Acoustics Division Student Paper Competition	2023
Student best paper finalists, Academic Forum of Mechanics between Ningbo University and Zhejiang University	2018
Student best paper finalists, Symposium on Piezoelectricity Acoustical Theory and Device Application	2016

Presentations

Topological surface acoustic wave, International Mechanical Engineering Congress Exposition, New Orleans	Oct. 2023
Smart patterning for topological pumping of surface waves, SPIE Smart Structures + NDE, Los Angeles	Mar. 2023

Skills

Languages: MATLAB, Fortran, Python, Jupyter, C/C++, Latex, HTML/CSS
Software: COMSOL, ANASYS, ABAQUS, SOLIDWORKS, Multisim, Simulink
Hardware: Mircocontroller, Electric Circuits, DIC, MTS Testing Machine, Laser Vibrometers

References

Professor Guoliang Huang
College of Engineering
Peking University
Beijing 100871, PR China
573-953-8845
guohuang@pku.edu.cn

Professor Emil Prodan
Department of Physics and
Department of Mathematical
Sciences
Yeshiva University
New York, New York 10016
212-340-7831
prodan@yu.edu

Professor Zheng Yan
Chemical and Biomedical
Engineering and Mechanical and
Aerospace Engineering
University of Missouri
Columbia, MO 65211
573-884-0562
YanZheng@missouri.edu