Xinyu Wang

PRESENT ADDRESS

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EDUCATION

Ph.D. in Engineering — March 2021
School of Civil Engineering, Southeast University, China
Advisors: Prof. **Jian Feng** & Prof. **Jianguo Cai**
Thesis: *Geometry and mechanics of origami and kirigami inspired metamaterials*

Visiting Ph.D. student — 2018 -2020
Department of Physics and Astronomy, University of Pennsylvania
Advisors: Prof. **Randall Kamien** & Prof. **Shu Yang**

B.S. in Engineering — 2015
School of Civil Engineering, Southeast University, China

POSITIONS

Postdoc Researcher — February 2021 - June 2023
Department of Physics, HKUST
Advisor: Prof. **Rui Zhang**

Postdoc Researcher — July 2023- present
Department of Physics, Umich
Advisor: Prof. **Xiaoming Mao**

RESEARCH INTERESTS

My research interests include material geometry and mechanics, morphing structures, mechanical metamaterials, topological metamaterials, liquid crystal elastomers, liquid crystals, form-finding, and active matters.

RESEARCH EXPERIENCES

- Understanding crack propagation in topological lattice — 2023-
- Exploring liquid crystal elastomer simulation methods — 2021-2023
- Working on understanding and manipulating topological defect structures of nematic liquid crystals in patterned systems — 2021-2023
- Studied geometry and mechanics in various helical deformation of topographical strips; explore shape morphing rules for topographical surfaces (combining numerical simulations, experiments and theory) — 2018-2021
- Designed a novel interleaved *kirigami* structure and explored its outstanding mechanical properties using experiments and simulations — 2018-2019
- Fabricated and tested an origami-based deployable spacecrafts — 2016-2018
- Developed form-finding and optimization algorithms for tensegrity structures and cable-net structures — 2015-2016
- Designed and 3D printed a deployable truss structure — 2015-2016

SOFTWARE SKILLS AutoCad, Adobe Illustrator, Paraview, ImageJ, Blender, Matlab, Mathematica, Python, C, Abaqus, Comsol, Office, Linux

PUBLICATIONS

Submitted

1. X. Wang, S. Sarkar, S. Gonella, X. Mao, " Topological mechanical metamaterial for robust and ductile one-way fracturing". Under review.
2. S. Yi, H. Chen, X. Wang, M. Jiang, B. Li, Q. Wei, R. Zhang, "Line defects in nematic liquid crystals as charged superelastic rods with negative twist–stretch coupling". arXiv preprint arXiv:2312.14735.

Published:

See Google Scholar for citation.

† Equal contribution

1. J. Jiang†, O.I. Akomolafe†, X. Wang†, Z. Asilehan, W. Tang, J. Zhang, Z. Chen, R. Wang, K. Ranabhat, R. Zhang, C. Peng, 2024. "Topology-driven collective dynamics of nematic colloidal entanglement". ***Proceedings of the National Academy of Sciences***, 121(37), p.e2402395121.
2. X. Wang†, J. Jiang†, J. Chen†, Z. Asilehan, W. Tang, C. Peng, R. Zhang, "Moiré effect enables versatile design oftopological defects in nematic liquid crystals". ***Nature Communications*** **15**, 1655 (2024).
3. J. Jiang†, X. Wang†, Ol. Akomolafe†, W. Tang, Z. Asilenhan, K. Ranabhat, R. Zhang, C. Peng "Collective transport and reconfigurable assembly of nematic colloids by light-driven cooperative molecular reorientations." ***Proceedings of the National Academy of Sciences*** 120.16 (2023): e2221718120.
4. M. Tanaka†, X.Wang†, C. Mishra, J. Cai, J. Feng, R.Kamien, A. Yodh, "Ratchetlike motion of helical bilayers induced by boundary constraints", ***Physical Review E***(2022), 106(1), L012605.
5. J. Jing†, K. Ranabhat†, X.Wang†, H. Rich, R. Zhang, C. Peng, "Transformation of topological structures in active nematic disclination networks", ***Proceedings of the National Academy of Sciences*** (2022), 119(23), 2122226119.
6. X. Wang, J. Zhang, J. Cai, J. Feng, "An improved energy method for form-finding of mesh reflectors", ***Archive of Applied Mechanics*** (2022), **92**, 2795–2812.
7. X. Wang, J. Cai, D. S. Lee, Y. Xu, J. Feng, "Numerical form finding of multi order tensegrity structures by grouping elements", ***Steel and Composite Structures*** (2021), 41(2), 267-277.
8. Q. Zhang, X. Wang, J. Cai, R. Yang, J. Feng, "Prestress design for cable-strut structures by grouping elements", ***Engineering Structures*** (2021), 244, 112010.
9. Q. Zhang, X. Wang, J. Cai, J. Feng, "Motion paths and mechanical behavior of origami-inspired tunable structures", ***Mechanics Research Communications*** (2021), 26, 101872.
10. Q. Zhang, X. Wang, D. S. Lee, J. Cai, Z. Ren, J. Feng, "Development of kinetic origami canopy using Arc Miura folding patterns", ***Journal of Building Engineering*** (2021), 43, 103116.
11. X. Wang, S.D. Guest, R.D. Kamien, "Keeping It Together: Interleaved Kirigami Extension Assembly", ***Physical Review X*** (2020), 10(1), 011013.

12. Q. Zhang, X. Wang, J. Cai, J. Zhang, Jian Feng, "Closed-Form Solutions for the Form-Finding of Regular Tensegrity Structures by Group Elements", ***Symmetry*** (2020), **12**, 374.
13. J. Cai, R. Yang, X. Wang, J. Feng, "Effect of initial imperfections of struts on the mechanical behavior of tensegrity structures", ***Composite Structures*** (2019), **207**, 871-876.
14. X. Wang, J. Cai, R. Yang, J. Feng, "Form-finding of deployable mesh reflectors using dynamic relaxation method", ***Acta Astronautica*** (2018), **151**, 380-388.
15. J. Cai, Y. Zhou, X. Wang, Y. Xu, J. Feng, "Dynamic analysis of a cylindrical boom based on Miura origami", ***Steel and Composite Structures*** (2018), **28**, 607-615.
16. J. Cai, X. Wang, X. Deng, J. Feng, "Form-finding method for multi-mode tensegrity structures using extend force density method by grouping elements", ***Composite Structures*** (2018), **187**, pp.1-9.
17. J. Cai, X. Wang, R. Yang, J. Feng,"Mechanical behavior of tensegrity structures with High-mode imperfections", ***Mechanics Research Communications*** (2018), **94**, 58-63.

In preparation:

1. X. Wang, R. Zhang." Curvature and torsion induced shape-morphing liquid crystal elastomers".

PRESS

Kirigami designs hold thousands of times their own weight
Penn Today. *INVERSE*. *TechXplore*. *Cosmos*.

PRESENTATIONS

"Mechanical metamaterial from geometry and topology", USTC, Hefei, Sep 2024. (Invited)
"Moiré effect enables versatile design oftopological defects in nematic liquid crystals", Contributed oral talk, The 8th International soft matter conference (ISMC), Aug 2024.
"Fracturing and Controlled Cracking Path in Topological Maxwell Lattice", APS March Meeting 2024, Minneapolis.
"Moiré effect enables versatile design oftopological defects in nematic liquid crystals", UPenn, Nov 2023. (Invited)
"Shape Selection of Pre-shaped Liquid Crystal Elastomer Strips", The 26th Annual Conference of HKSTAM 2023.
"Emerging Topological Structures in Nematic Moiré Patterns", APS March Meeting, 2023.
"Shape-selection of Pre-shaped Liquid Crystal Elastomers", Soft Matter Day at HKUST, December 2022.
"Active control of Periodic, Three-Dimensional Disclination Networks in Nematic Liquid Crystals", APS March Meeting, Chicago, March 2022.
"Origami Based Cylindrical Mechanical Metamaterial", In Proceedings of IASS Annual Symposia. International Association for Shell and Spatial Structures (IASS), MIT, July 2018.
"A Deployable Origami Tube for Light-Shielding Space Craft" (poster), the Second International Workshop on Origami Engineering, November 2017.

GRANDS AND AWARDS

UMich Postdoc Travel Award 2024
HKUST Research Travel Grant 2023
HKUST Post-Doctoral Fellowship (PDF) Matching Fund 2021
Chinese Scholar Council Fellowship, Chinese government 2018-2019
Prestress Structure Scholarship, Southeast University 2018

OTHER ACADEMIC ACTIVITIES

Organization assistant of Soft Matter Day 2022, HKUST 2021-2022
Organization assistant of a joint symposium, HKUST 2021
Participated in Topology Workshop at University of Delaware 2019
Participated in Topology Workshop at Rutgers University 2018
Organization assistant of Deployable Structure Workshop, Southeat University 2018
Organization assistant of Deployable Structure Workshop, Southeat University 2016

OUTREACH ACTIVITIES

Facilitator, Philly Materials Science and Engineering Day 2019, 2020
-*Showed kids origami and kirigami inspired designs and potential applications*
Facilitator, summer project in Penn GRASP lab 2019
-*Taught high school students how to make kirigami motifs*