Fan Feng

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Education

Ph.D. in Solid Mechanics from University of Minnesota, 2018
Advisor: Professor Richard D. James

B.Sc. in Mathematics and Physics from Tsinghua University, 2012

Professional Experience

2023 –	Assistant Professor, School of Mechanics and Engineering Science, Peking University
2019 – 2023	Postdoctoral Scholar, University of Cambridge Advisor: Professor Mark Warner FRS (deceased) and Professor John Biggins
2018 – 2019	Postdoctoral Scholar, University of Minnesota Advisor: Professor Richard D. James

Research Interests

The geometric mechanics approach to the rational design of functional/phase-transforming materials and structures, enabling applications in energy conversion, sustainability, aerospace engineering, and robotics. Research topics include: martensitic phase transformations and elastocaloric cooling, liquid crystal elastomers and soft robotics, origami and kirigami design, as well as mechanics of surfaces and interfaces under extreme conditions.

Publications

(see Google Scholar; * co-corresponding author, † equal contribution; including preprints)

1. Z. Wen, T. Yu, and F. Feng. Geometry and mechanics of non-euclidean curved-crease origami. *arXiv preprint arXiv:2502.20147*, 2025.
2. H. Gu and F. Feng. Simplified cofactor conditions for cubic to tetragonal, orthorhombic, and monoclinic phase transformations. *arXiv preprint arXiv:2503.24224*, 2025.
3. L. Wang and F. Feng. A continuum mechanics approach for the deformation of non-euclidean origami generated by piecewise constant nematic director fields. *arXiv preprint arXiv:2506.01309*, 2025.
4. F. Feng. Objective moiré patterns. *Journal of Applied Mechanics*, 92(8):081002, 2025.

5. Z. Wen, P. Lv, F. Feng, and H. Duan. A generalized geometric mechanics theory for multi-curve-fold origami: vertex constrained universal configurations. *Journal of the Mechanics and Physics of Solids*, 192:105829, 2024.
6. F. Feng, K. Dradrach, M. Zmyślony, M. Barnes, and J. S. Biggins. Geometry, mechanics and actuation of intrinsically curved folds. *Soft Matter*, 20(9):2132–2140, 2024.
7. Y. Zou, F. Feng, K. Liu, P. Lv, and H. Duan. Kinematics and dynamics of non-developable origami. *Proceedings of the Royal Society A*, 480(2282):20230610, 2024.
8. M. Barnes, F. Feng, and J. S. Biggins. Surface instability in a nematic elastomer. *Physical Review Letters*, 131(23):238101, 2023.
9. Q. Chen, F. Feng, P. Lv, and H. Duan. Origami spring-inspired shape morphing for flexible robotics. *Soft Robotics*, 9(4):798–806, 2022.
10. F. Feng, D. Duffy, M. Warner, and J. S. Biggins. Interfacial metric mechanics: stitching patterns of shape change in active sheets. *Proceedings of the Royal Society A*, 478(2262):20220230, 2022.
11. L. Lu, X. Dang, F. Feng, P. Lv, and H. Duan. Conical kresling origami and its applications to curvature and energy programming. *Proceedings of the Royal Society A*, 478(2257):20210712, 2022.
12. X. Dang, F. Feng, H. Duan, and J. Wang. Theorem for the design of deployable kirigami tessellations with different topologies. *Physical Review E*, 104(5):055006, 2021.
13. X. Dang, F. Feng, H. Duan, and J. Wang. Theorem on the compatibility of spherical kirigami tessellations. *Physical Review Letters*, 128(3):035501, 2022.
14. H. Liu, P. Plucinsky, F. Feng, A. Soor, and R. D. James. Origami and the structure of materials. *SIAM News*, 55(1), 2022.
15. X. Dang, F. Feng, P. Plucinsky, R. D. James, H. Duan, and J. Wang. Inverse design of deployable origami structures that approximate a general surface. *International Journal of Solids and Structures*, 234:111224, 2022.
16. D. Duffy, L. Cmok, J. Biggins, A. Krishna, C. D. Modes, M. Abdelrahman, M. Javed, T. Ware, F. Feng, and M. Warner. Shape programming lines of concentrated gaussian curvature. *Journal of Applied Physics*, 129(22), 2021.
17. H. Liu, P. Plucinsky, F. Feng, and R. D. James. Origami and materials science. *Philosophical Transactions of the Royal Society A*, 379(2201):20200113, 2021.
18. F. Feng, J. S. Biggins, and M. Warner. Evolving, complex topography from combining centers of Gaussian curvature. *Physical Review E*, 102(1):013003, 2020.
19. F. Feng, X. Dang, R. D. James, and P. Plucinsky. The designs and deformations of rigidly and flat-foldable quadrilateral mesh origami. *Journal of the Mechanics and Physics of Solids*, 142:104018, 2020.
20. F. Feng, P. Plucinsky, and R. D. James. Helical Miura origami. *Physical Review E*, 101(3):033002, 2020.
21. F. Feng, P. Plucinsky, and R. D. James. Phase transformations and compatibility in helical structures. *Journal of the Mechanics and Physics of Solids*, 131:74–95, 2019.

22. F. Feng. *Phase transformation in helical structures: Theory and application*. PhD thesis, University of Minnesota, 2018.
23. Y. Ganor, T. Dumitrică, F. Feng, and R. D. James. Zig-zag twins and helical phase transformations. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 374(2066):20150208, 2016.

Research Grants

2024 "Mechanics of soft materials containing mesoscale twinning microstructures", General Project from the National Natural Science Foundation of China, PI, ¥523.9k/4y

2023 Start-up Funding from Peking University, PI, ¥1,000k/3y

Current Students

Kai Wan, Qingyun Zeng

Postdocs

Fawad Ahmed Mangrio, Hanlin Gu (Boya Posdoc Fellow), Jianhao Chen (upcoming assistant professor at Beijing University of Technology)

Invited Presentations

2025

Geometric mechanics theory for phase transforming materials and structures. *Solid mechanics group, Tsinghua University, Beijing, March, 2025*

Solid-solid phase transformations in materials and structures. *University of Science and Technology of China, Hefei, July 6, 2025*

Mixed lattice correspondence in tetragonal to monoclinic phase transformations. *Symposium on Mechanics and Engineering Science, Peking University, Beijing, May 23–25, 2025*

2024

Geometric mechanics theory for phase transforming materials and structures. *Hong Kong University of Science and Technology, Hong Kong, Nov 29, 2024*

Towards Euclidean and non-Euclidean origami. *The 1st Sino-UK Workshop on Mechanics of Advanced Structural Materials, University of Cambridge, UK, July 17-19, 2024*

Surface instability in liquid crystal elastomers. *IAS Focused Program, Hong Kong University of Science and Technology, Hong Kong, Mar 26-30, 2024*

2023

Shape programming and pattern formation in liquid crystal elastomers. *The University of Edinburgh, UK, May 2023*

Before

Shape programming and pattern formation in liquid crystal elastomers, *BIRS workshop, Banff, Canada, July 24-29, 2022*

Theory-guided design of novel materials and structures. *University of Science and Technology of China, April, 2021*

Forward and inverse problems in origami design. *The Invariants Talk, University of Oxford. UK, Nov, 2020*

Phase transformations in atomic structures and origami. *Xi'an Jiaotong University, China, Sep, 2019*

Phase transformations in atomic structures and origami. *2019 International Forum of Excellent Young Talents in Engineering Sciences, Peking University, Beijing, March, 2019*

Compatibility conditions in origami design. *The First International Workshop on Martensitic Microstructures, Minneapolis, May, 2018*

Deformable helical Miura origami inspired by phase transformation. *Solid Seminar, AEM, University of Minnesota, Minneapolis, Sep, 2017*

Conference Presentations

2025

Programming active straight and curved fold origami with liquid crystal elastomer sheets (invited). *The 2nd National Conference on Smart Materials and Structures, To be held in Guangzhou, China, Nov 1-2, 2025*

Programming actuations and colours in cholesteric elastomer balloons (invited). *The 4th National Soft Matter Mechanics Conference, To be held in Hefei, China, Nov 7-9, 2025*

Multiscale mechanics of liquid crystal elastomers. *The 23rd Annual Conference of the Chinese Society for Industrial and Applied Mathematics (CSIAM 2025), To be held in Changsha, China, Oct 23-26, 2025*

Geometry and Mechanics of Non-Euclidean Curved-Crease Origami (invited). *The 31st International Conference on Computational & Experimental Engineering and Sciences (ICCES2025), Changsha, China, May 25-29, 2025*

Mixed lattice correspondences in tetragonal to monoclinic phase transformations. *The 4th National Metamaterials Conference (China), Shenzhen, May 15–18, 2025*

2024

Objective moiré patterns (invited). *The 3rd National Soft Matter Mechanics Conference, Xi'an, China, Nov 1-3, 2024*

Rational design of deployable/multistable origami and kirigami structures (invited). *SES 2024 Annual Technical Meeting, Hangzhou, China, Aug 20-23, 2024.*

Surface Instability in Liquid Crystal Elastomers(invited). *The 30th International Conference*

on Computational & Experimental Engineering and Sciences (ICCES 2024), Singapore, Aug 3-6, 2024

Towards Euclidean and Non-Euclidean origami, *The 1st Sino-UK Workshop on Mechanics of Advanced Structural Materials, University of Cambridge, UK, July 17-19, 2024*

Shape programming and pattern formation in liquid crystal elastomers. *The 3rd International Conference on Nonlinear Solid Mechanics (ICoNSoM 2024), Cagliari, Sardinia, Italy, June 11-14, 2024*

2023

The design of curved-fold origami based on liquid crystal elastomer sheets (Invited). *The 1st National Conference on Smart Materials and Structures, Suzhou, China, Oct 27-29, 2023*

Surface instability in liquid crystal elastomers (invited), *The 2nd National Soft Matter Mechanics Conference, Hangzhou, China, Nov 10-12, 2023*

Before

The designs of rigidly deployable quadrilateral origami and kirigami. *MS 22 Mathematical Aspects of Origami Design, SIAM Conference on Mathematical Aspects of Materials Science, virtual conference, May, 2021*

Non-isometric origami. *Edwards Centre January meeting, University of Cambridge, Jan, 2020*

Helical Miura Origami (Symposium co-organizer, postponed to 2021). *SIAM Conference on Mathematical Aspects of Materials Science (MS20), Bilbao, Spain, May, 2020*

Phase-transforming helical Miura origami: theory and prototype. *The 9th International Congress on Industrial and Applied Mathematics (ICIAM 2019), Valencia, Spain, July, 2019*

Several results on phase transformation in helical structures. *Kaushik Bhattacharya Outstanding Achievement Award Symposium, Minneapolis, Oct, 2018*

Workshop Attendance

Isaac Newton Institute for Mathematical Sciences Workshop on "Recent challenges in the mathematical design of new materials", August 18-22, Cambridge, UK 2025

IAS Focused Program on "Continuum theory and mathematical modeling of phase-transition materials–A symposium in honor of Professor Richard D. James on his 70th birthday", Mar 26-30, Hong Kong University of Science and Technology, Hong Kong 2024

BIRS Workshop on "Equilibrium and non-Equilibrium Pattern Formation in Soft Matter: From Elastic Solids to Complex Fluids", The Banff International Research Station for Mathematical Innovation and Discovery (BIRS), July 24-29, Banff, Canada 2022

CISM Advanced Course on "Pattern Formation in Advanced Materials: Energetics and Evolution", July 22-26, Udine, Italy 2019

Graduate Summer School of the 2014 IAS/Park City Mathematics Institute (PCMI) Summer

Session, June 29-July 19, Park City, Utah, USA 2014

Teaching Experience

• Peking University, Lecturer

Undergraduate level: Mathematical Analysis III (2025 Fall); Advanced Calculus (2024 Fall)

Graduate level: Macro- and Micromechanical Behaviors of Materials (2025 Spring); Differential Geometry and Mechanics (2024 Spring)

Summer school: Origami Design (2019 Summer)

• Cambridge University

TA and Demonstrator (undergraduate level): M3 Materials Modeling Lab 2023

• University of Minnesota

Instructor (graduate level, several lectures): Theory of Elasticity 2019

TA (undergraduate level): Aerospace Propulsion, Aerodynamics, Fluid Mechanics, Statics and Dynamics 2012 – 2013

Mentorship Experience

Mentored undergraduate student Boyang Chen at Peking University. 2025

Mentored graduate students Xiangxin Dang, Qianying Chen, Yu Zou, and Zhixuan Wen at Peking University. 2019 – 2020

Frank Yu, Wayzata High School 2017 – 2018
Project: Design and Prototype of Helical Miura Origami
Honor: Scholar of Distinction in Mathematics, University of Minnesota

Academic Service

• Referee of journals
Journal of the Mechanics and Physics of Solids, Physical Review Letters, Journal of Alloys and Compounds, International Journal of Engineering Science, Scientific Report, Frontiers in Robotics and AI, Journal of Sound and Vibration, Acta Materialia, Proceedings of the Royal Society A, Extreme Mechanics Letters, Communications Materials, International Journal of Solids and Structures, Physical Review Applied, and more.

• Organizer or co-organizer of workshops/symposiums
Mathematical and Mechanical Design of New Materials, *Tianyuan Mathematics Research Center, To be held in Kunming, China.* 2026/06

10.2 Micromechanics, Biomechanics, and Mathematical Modeling of Materials, *SES 2024 Annual Technical Meeting, Hangzhou, China.* 2024/08

S79 Soft Materials -Bridging Theory, Modeling and Experiment, *The 30th International Conference on Computational & Experimental Engineering and Sciences (ICCES 2024), Singapore.* 2024/08

MS 22 Mathematical Aspects of Origami Design, *SIAM Conference on Mathematical Aspects of Materials Science, virtual conference.* 2021/05

• **Professional organizations**
Society of Engineering Science (SES), Chinese Society of Theoretical and Applied Mechanics (CSTAM, Professional Committee on Rational Mechanics and Mathematical Methods in Mechanics), Society for Industrial and Applied Mathematics (SIAM), Chinese Society for Industrial and Applied Mathematics (CSIAM).

Awards and Fellowships

SIAM Travel Award for ICIAM 2019, Valencia, Spain 2019

John and Jane Dunning Copper Fellowship, University of Minnesota, USA 2013

Outstanding Student Scholarship, Tsinghua University, China 2009 – 2011

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