FANGJIE QI

Work Address: 1001 Capability Dr, Raleigh NC 27606

Phone: +1 (424) 421-9706 | **E-Mail**: fqi@ncsu.edu | **Google Scholar**

EDUCATION

2021 – 2026	**NORTH CAROLINA STATE UNIVERSITY**	Raleigh, USA
	Ph.D. in Mechanical Engineering	
2019 – 2021	**UNIVERSITY OF SOUTHERN CALIFORNIA**	Los Angeles, USA
	Master of Science in Manufacturing Engineering	
2015 - 2019	**HEFEI UNIVERSITY OF TECHNOLOGY**	Hefei, China
	Bachelor of Engineering in Industrial Engineering	

RESEARCH INTERESTS

My research focuses on *soft robotics*, *active materials*, and *advanced manufacturing*, with an emphasis on developing **adaptive robotic systems** capable of interacting with complex environments. I am particularly interested in integrating material design, actuation, structural mechanics, and fabrication to create multifunctional soft machines with enhanced mobility, sensing, and autonomy. My work spans the design of active material actuators, soft locomotion systems, and robot–environment interaction. More broadly, I seek to bridge materials, structures, and robotic systems to enable next-generation soft robots for biomedical, industrial, and exploratory applications.

RESEARCH EXPERIENCE

*Applied Materials Lab, NCSU, Supervised by Professor **Jie Yin***

02/2025 - present **A braided fabrication method for LCE-based structured fabrics**

• Designed and built a series of automatic 3D printer / braiding machine / weaving machine for mass production of smart fabrics (tens of meters in length, diameter from 80 μm to 1 mm).

• Investigated a mechanical model to understand the coupling between material properties, fiber geometry, and fabric architecture.

• Designed a swimming robot composed of passive PET beam with braided LCE fabric, capable of tunable swimming mobility and steering.

10/2024 - 02/2026 **A self-resetting soft ring for continuous leaping in unstructured environments**

• Designed a novel soft robot of LCE to achieve multimodal locomotion.

• Analytically depicted the geometric and actuation boundary conditions of various behaviors.

• Bridged the gap between soft robots operating in ideal laboratory conditions and those functioning in unstructured environments.

10/2022 - 04/2025 **Aerial track-guided autonomous soft ring robot**

• Lead role in design, fabrication and experiment on the soft robot inspired by aerial transportations.

• Developed a track-guided autonomous robot that adapts to diverse tracks, transports load over 12× its weight, and navigates steep slopes, obstacles, and complex paths.

09/2021 - 01/2023 **Defected twisted ring topology for autonomous periodic flip–spin–orbit soft robot**

• Lead role in design, fabrication and experiment on the soft robot based on liquid crystal elastomers.

• By utilizing the twisting-encoded autonomous flip–spin–orbit motions, revealed the robot's potential for intelligently mapping the geometric boundaries of unknown confined spaces.

Center for Advanced Manufacturing, USC, Supervised by Professor ***Yong Chen***

01/2020 - 10/2021 **High precision stereolithography for multifunctional microfluidics**

• Developed a high-precision stereolithography 3D printer for microfluidic devices.

• Performed statistical analysis on data from experiment results to demonstrate particle sorting efficiency with printed sorting device and flow rate controlling with micro-valve.

• Modeled a COMSOL simulation to evaluate the performance of the printed micro-valve.

07/2019 - 12/2020 **A Novel Droplet-punching Capillary-splitting 3D Printing Method for Highly Viscous Materials**

• Optimized Centroid Voronoi Tessellation algorithm to schedule nozzles toolpath for multi-materials printing.

• Demonstrated that the droplet-punching mechanism enables printing of materials with viscosities up to 190,000 mPa·s.

PUBLICATION

[1] **F. Qi,** C. Zhou,H. Qing,H. Sun,Y. Hong, & J. Yin, A self-resetting soft ring for autonomous, continuous leaping in unstructured environments, *Proc. Natl. Acad. Sci. U.S.A.* 123 (35) e2607940123, https://doi.org/10.1073/pnas.2607940123

[2] **F. Qi**, C. Zhou, H. Qing, H. Sun, J. Yin, Aerial Track-Guided Autonomous Soft Ring Robot. *Adv. Sci.* 2025, 12, 2503288. https://doi.org/10.1002/advs.202503288

[3] **F. Qi**, Y. Li, Y. Hong, Y. Zhao, H. Qing, J. Yin, Defected twisted ring topology for autonomous periodic flip–spin–orbit soft robot, *Proc. Natl. Acad. Sci. U.S.A.* 121 (3) e2312680121, (2024). https://doi.org/10.1073/pnas.2312680121

[4] **F. Qi**, C. Zhou, H. Pan, H. Sun, J. Yin, A braided fabrication method for structured fabrics, *In preparation*.

[5] Y. Zhao, Y. Hong, **F. Qi**, Y. Chi, H. Su, J. Yin, Self-Sustained Snapping Drives Autonomous Dancing and Motion in Free-Standing Wavy Rings. *Adv. Mater.* 2023, 35, 2207372. https://doi.org/10.1002/adma.202207372

[6] H. Qing, C. Zhou, **F. Qi**, J. Yin, Programmable seconds-to-days-long delayed snapping in jumping metashells, *Proc. Natl. Acad. Sci. U.S.A.* 122 (23) e2503313122, (2025). https://doi.org/10.1073/pnas.2503313122

[7] Y. Li, S. Yu, H. Qing, Y. Hong, Y. Zhao, **F. Qi**, H. Su. J. Yin. Reprogrammable and reconfigurable mechanical computing metastructures with stable and high-density memory.Sci. Adv.10,eado6476(2024).DOI:10.1126/sciadv.ado6476

[8] Y. Zhao Y. Hong, **F. Qi**, H. Qing, H. Su, J. Yin, Physically intelligent autonomous soft robotic maze escaper. *Sci. Adv*.9,eadi3254(2023). https://www.science.org/doi/full/10.1126/sciadv.adi3254

[9] H. Qing, Y. Chi, Y. Hong, Y. Zhao, **F. Qi**, Y. Li, J. Yin, Fully 3D-Printed Miniature Soft Hydraulic Actuators with Shape Memory Effect for Morphing and Manipulation. *Adv. Mater.* 2024, 36, 2402517. https://doi.org/10.1002/adma.202402517

[10] Xu, Y., **Qi, F.**, Mao, H. et al. In-situ transfer vat photopolymerization for transparent microfluidic device fabrication. *Nat Commun* 13, 918 (2022). https://doi.org/10.1038/s41467-022-28579-z

[11] L. Jiang, G. Lu, Y. Yang, Y. Xu, **F. Qi**, J. Li, B. Zhu, Y. Chen, Multichannel Piezo-Ultrasound Implant with Hybrid Waterborne Acoustic Metastructure for Selective Wireless Energy Transfer at Megahertz Frequencies. *Adv. Mater.* 2021, 33, 2104251. https://doi.org/10.1002/adma.202104251

BOOK CHAPTER

[1] Zhao, Y., **Qi, F.**, Sun, H., Li, Y., Qing, H. and Yin, J. (2024). Harnessing Wrinkling and Buckling Instabilities for Stretchable Devices and Healthcare. In Mechanics of Flexible and Stretchable Electronics (eds Y. Zhu and N. Lu). https://doi.org/10.1002/9783527842308.ch10

GRANT APPLICATIONS

NSF standard grant

• Title: Self-powered Electrochemical Actuators toward Untethered Soft Mobile Robots

• PI: Dr. Jie Yin

• Contributions: Led one research thrust, including problem formulation, coordination with collaborators, and technical writing.

• Requested for $341,142.00 for 3 years, starting from September 1st, 2023.

NSF standard grant

• Title: Manufacturing, Mechanics and Actuation of Liquid Crystal Elastomer (LCE)-based Architected Fabrics

• PI: Dr. Jie Yin

• Contributions: Led one research thrust, including problem formulation, and technical writing.

• Requested for $599,999.00 for 3 years, starting from September 1st, 2025.

MENTORING AND TEACHING EXPERIENCE

• **Teaching assistant**: MAE 306 Mechanical Engineering Laboratory, NCSU, Spring 2023 & Spring 2025.

• **Teaching assistant**: MAE 316 Strength of Mechanical Components, NCSU, Fall 2024.

• Mentored 4 undergraduate students on soft robotic fabrication and testing, FEA simulation.

CONFERENCE AND PRESENTATIONS

• **Presenter**: Defected twisted ring topology for autonomous periodic flip–spin–orbit soft robot

Society of Engineering Science (SES) Annual Technical Meeting; Minneapolis, Minnesota 9th – 11th October 2023.

• **Presenter**: A self-resetting soft ring for autonomous, continuous leaping in unstructured environments

Society of Engineering Science (SES) Annual Technical Meeting; Atlanta, Geogia; 12th – 15th October 2025.

SKILLS

Material synthesis: Liquid crystal elastomer (Azo-LCP, Michael addition), Hydrogel (Alginate-based)
Mechatronics: Additive manufacturing (including slicing and toolpath generation), Electrospinning
Coding: C++ (STL, Qt), Python (machine learning, OpenCV), MATLAB (Math, Simulink)
Analysis & Visualization: Abaqus (FEA), Matplotlib (chart), Photoshop (images), Premiere pro (videos)

CONTACT INFORMATION OF REFERENCES

1. Dr. **Jie Yin**, Professor, Department of Mechanical and Aerospace Engineering, North Carolina State University

Email address: jyin8@ncsu.edu

2. Dr. **Yong Chen**, Department Head and Chair Professor, Department of Mechanical and Aerospace Engineering, The Hong Kong University of Science and Technology.

Email address: yongchen@ust.hk

3. Dr. **Liming Xiong**, Associate Professor, Department of Mechanical and Aerospace Engineering, North Carolina State University

Email address: lxiong3@ncsu.edu