YIDE LIU

Zhejiang University, Hangzhou, China
Email: yide_liu@zju.edu.cn
[Google Scholar][ResearchGate][YouTube Channel]

EDUCTAION

Ph.D., Zhejiang University in Mechanics September 2018 - July 2023

- Thesis title: Structure design and bionic control of micro robots and assembly system
- Advisor: Prof. Shaoxing Qu
- ***2021*** Zengqi Lu Outstanding Ph.D. students award of State Key Laboratory of Fluid Power and Mechatronic Systems

RESEARCH INTERESTS AND SKILLS

Interests: Robotic Insects / Multi-robot Systems / Central Pattern Generator / Small Parallel Robots
Skills: Solidworks, Adams, Abaqus, Python, Matlab, Mathematica, LaTeX

RESEARCH PROJECTS

High Speed Untethered Insect-scale Inchworm Robot, *S^2worm* 2019 - now

- Build an untethered insect-scale inchworm robot S^2worm
  weighs 4.34 g, spans 4.1 cm, top average speed 27.4 cm/s - *one of the best insect-scale robot for its speed and autonomous*
- Design a novel 2-DoF parallel mechanism for insect-scale robot through screw theory and type synthesis method - *the first time the type synthesis method is applied in the field of the insect-scale robot to improve the efficacy of the transmission mechanism*
- Optimize the mobility performance of the $S^2worm-G$ through the Grassmann-Cayley Algebra
  Found and solved the singularity problem of the novel 2-DoF transmission mechanism.
  the speed of the untethered prototype reaches 75 cm/s (submit to IEEE T-RO)
- The S^2worm series insect-scale robot is promising for application in planetary exploration, earthquake search and constructing insect-scale multi-robot systems such as *BioARS*

Bionic Assembly Robotic System, *BioARS* 2019 - now

- Build an assembly robotic system with inchworm robots as modules (Bionic Assembly Robotic System, *BioARS*)
  The *BioARS* can pass through confined spaces as a swarm or assemble into a quadruped robot to walk
- Apply central pattern generator to control the gait of the assembled quadruped configuration of the *BioARS*
  The quadruped configuration of the *BioARS* can perform different gaits (under paper preparation)
- The *BioARS* can explore the planet or search after the earthquake for its multi-terrain adaptability

Untethered Insect-scale Flapping-wing Robot, *Robomoth* 2020 - 2022

- Build an untethered insect-scale flapping-wing robot through SCM method
  weighs 2.49 g, spans 5.9 cm, top average speed on water 17.1 cm/s
- Develop a simplified dynamic model to demonstrate the frequency-related response of the flapping system
  the model can guide the design of the dynamic behavior of the piezoelectric-driven flapping-wing system

RESEARCH PROJECTS (CONTINUED)

Micro 4-DoF Parallel Manipulator 2020 - now

- Build a centimeter scale 4-DoF parallel manipulator through SCM method
- Design the SCM fabrication process and the assembling process of the complex close-loop structure
- Apply parallel mechanism theory to optimize the rigidity of the manipulator, the rigidity achieves 50 N/mm
- The manipulator can be applied in microsurgery and micro-assembly automation

Bistable Rotating Mechanism 2017 - 2019

- Build a bistable rotating mechanism using dielectric elastomer actuators
- Develop an analytical model to design electromechanical behavior of the bistable rotating mechanism the model can guide the design of the bistability of the bistable system
- Build a binary manipulator to demonstrate that the bistable rotating mechanism can provide a promising route for the design of binary systems

PUBLICATIONS

Yide Liu, Bo Feng, Tianlun Cheng, Yanhong Chen, Xiyan Liu, Jiahang Zhang, Shaoxing Qu, and Wei Yang. (2023). Singularity Analysis and Solutions for the Origami Transmission Mechanism of Fast-Moving Untethered Insect-scale Robot. ***IEEE Transactions on Robotics***. (In revision)

Yide Liu, Yanhong Chen, Bo Feng, Dongqi Wang, Taishan Liu, Haofei Zhou, Hua Li, Shaoxing Qu, and Wei Yang. (2022) S^2worm: A Fast-moving Untethered Insect-scale Robot with 2-DoF Transmission Mechanism. ***IEEE Robotics and Automation Letters***, 7(3), 6758-6765.

Yanhong Chen #, Yide Liu#, Taishan Liu, Hua Li, Shaoxing Qu, and Wei Yang. (2022). Design and analysis of an untethered micro flapping robot which can glide on the water. ***SCIENCE CHINA Technological Sciences***, 65(8), 1749-1759. (#: co-first author)

Yide Liu, Donghao Zhao, Yanhong Chen, Dongqi Wang, Zhou Wen, Ziyi Ye, Jianhui Guo, Haofei Zhou, Shaoxing Qu, and Wei Yang. BioARS: Designing Adaptive and Reconfigurable Bionic Assembly Robotic System with Inchworm Modules. (2020). In ***2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*** (pp. 11681-11687). IEEE.

Yide Liu, Binhong Liu, Tenghao Yin, Yuhai Xiang, Haofei Zhou, Shaoxing Qu. (2019). Bistable rotating mechanism based on dielectric elastomer actuator. ***Smart Materials and Structures***, 29(1), 015008.

Donghao Zhao, Yide Liu, Binhong Liu, Zhe Chen, Guodong Nian, Shaoxing Qu, and Wei Yang. (2021). 3D printing method for tough multifunctional particle-based double-network hydrogels. ***ACS Applied Materials and Interfaces***, 13(11), 13714-13723.

Xiaocheng Hu, Yimou Fu, Yide Liu, Binhong Liu, and Shaoxing Qu. (2021). Acarid Suction Cup-Inspired Rapid and Tunable Magnetic Adhesion. ***Advanced Materials Technologies***, 6(8), 2100004.

Yimou Fu, Xiaocheng Hu, Yide Liu, Peng Wang, Shuo Chen, Haofei Zhou, Honghui Yu, Shaoxing Qu, and Wei Yang. (2022). Impact-induced bubble interactions and coalescence in soft materials. ***International Journal of Solids and Structures***, 238, 111387.

INTERNSHIP

DJI Technology Co., Ltd. July 2017

- Leader of the mechanical design internship group - *the group consists of 100 interns selected from over 1000 students*
- ***2017*** Third Place of the DJI international internship robot competition