Su Yinyin

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EDUCATION BACKGROUND

The University of Hong Kong (HKU)   **Hong Kong, China**
Ph.D. student in Robotics and Control, Faculty of Engineering   *Sept. 2020 - Present*
Supervised by Prof. James Lam and Prof. Zheng Wang

University of Chinese Academy of Sciences (UCAS)   **Beijing, China**
M.Sc. in General and Fundamental Mechanics, Institute of Mechanics   *Sept. 2014-Jun. 2017*
Supervised by Prof. Qi Kang

Northeastern University (NEU)   **Shenyang, China**
B.Eng. in Engineering Mechanics   *Sept. 2010-Jun. 2014*
GPA: 86.38/100

PUBLICATIONS

1. **Yinyin Su**, Xiaojiao Chen, Zhonggui Fang, Dong Liu, James Lam, Zheng Wang, "Spatial Position–Force Perception for a Soft Parallel Joint via Pressure-Deformation Self-Sensing", in *IEEE/ASME Transactions on Mechatronics (T-MECH)*, 2024.

2. Anlun Huang, Yongxi Cao, Jiajie Guo, Zhonggui Fang, **Yinyin Su**, Sicong Liu, Juan Yi, Hongqiang Wang, Jian S Dai, Zheng Wang, "Foam-Embedded Soft Robotic Joint With Inverse Kinematic Modeling by Iterative Self-Improving Learning", in *IEEE Robotics and Automation Letters (RA-L)*, 2024.

3. Zhonggui Fang, Yige Wu, **Yinyin Su**, Juan Yi, Sicong Liu, Zheng Wang, "Omnidirectional compliance on cross-linked actuator coordination enables simultaneous multi-functions of soft modular robots", in *Scientific Reports*, 2023.

4. Liangliang Wang, James Lam, Xiaojiao Chen, Jing Li, Runzhi Zhang, **Yinyin Su**, Zheng Wang. "Soft Robot Proprioception Using Unified Soft Body Encoding and Recurrent Neural Network", in *Soft Robotics*, 2023.

5. Juan Yi, Xiaojiao Chen, Zhonggui Fang, Yujia Liu, Dehao Duanmu, **Yinyin Su**, Chaoyang Song, Sicong Liu, Zheng Wang, "A Soft Wearable Elbow Skeleton for Safe Motion Assistance by Variable Stiffness", in *International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, 2022.

6. Jing Li, Xiaojiao Chen, **Yinyin Su**, Wenping Wang, James Lam, Zheng Wang, "Kinematic Analysis of Soft Continuum Manipulators Based on Sparse Workspace Mapping", in *IEEE Robotics and Automation Letters (RA-L)*, 2022.

7. **Yinyin Su**, Zhonggui Fang, Wenpei Zhu, Xiaochen Sun, Yuming Zhu, Hexiang Wang, Hailin Huang, Sicong Liu and Zheng Wang, "A Hybrid Robotic Gripper with High-payload Soft Origamic Actuators and Proprioception", in *IEEE International Conference on Robotics and Automation (ICRA) & IEEE Robotics and Automation Letters (RA-L)*, 2020.

8. Kang Qi, Wang Jia, Duan, Li, **Su Yinyin**, He Jianwu, Wu Di and Hu Wenrui, "The volume ratio effect on flow patterns and transition processes of thermocapillary convection", *Journal of Fluid Mechanic (JFM)*, 2019.

9. **Yinyin Su**, Yuquan Wang and Abderrahmane Kheddar, "Sample-efficient learning of soft task priorities through Bayesian optimization", in *IEEE-RAS 18th International Conference on Humanoid Robots (Humanoids)*, 2018.

10. **Su Yinyin**, Wu Di, Duan Li and Kang Qi, "Numerical Simulation of Flow Field in Centrifugal Cone-shaped Two - phase Washing Machine under Microgravity", *Manned Spaceflight*, 2018.

11. Yongqiang Li, Mingzhu Hu, Ling Liu, **YinYin Su**, Li Duan and Qi Kang, "Study of Capillary Driven Flow in an Interior Corner of Rounded Wall under Microgravity", *Microgravity Science and Technology*, 2015.

PATENTS

1. Zheng Wang, Sicong Liu, **Yinyin Su**, Zhonggui Fang, Ying Wei, "Balance control method for power inspection robot and soft waist platform," [**CN111805506A**].
2. Zheng Wang, Zhonggui Fang, **Yinyin Su**, Sicong Liu, Ying Wei, "Monitoring device for power inspection robot," [**CN111815797B**].
3. Zheng Wang, Zhonggui Fang, **Yinyin Su**, Wenpei Zhu, Sicong Liu, "Software-driven clamping jaw device," [**CN110802621A**].
4. Sicong Liu, Zhonggui Fang, **Yinyin Su**, Zheng Wang, "Driving device based on soft muscles," [**CN1108025-75A**].
5. Sicong Liu, **Yinyin Su**, Zheng Wang, "Sensing method of gas driver and gas driving system," [**CN1109485-26B**].

RESEARCH EXPERIENCE

Spatial multimodal perception, modeling, and control of a soft robot   *Sept. 2020 - Present*
- Inspired by the human arm, based on soft origami actuators, designed a soft parallel modular with the ability to realize multimodal perception.
- The self-sensing soft actuator can understand the real-time internal pressure and axial deformation by the embedded dedicated sensor PCB. Based on the actuator's sensing method, the spatial perceptive model is derived for the 3-DoF soft parallel robot, with the ability to perceive 3D position and three-axial forces simultaneously.
- Developed the real-time ball recognition system based on *Realsense*. The positions and orientations of the end-effector installed in the robotic arm can be realized through the full balls covered in different colors.
- with real-time position perceptions in various path-tracking experiments and force estimations in different initial states, the proposed perceptive scheme of the soft robot was verified.
- Based on the proposed self-sensing soft joint, a 3-segment soft manipulator was designed, where a redundant network proprioceptive scheme (RNPS) algorithm was developed to increase the ability of failure tolerance, especially if some embedded sensors failed. Also, the closed-loop control strategy with the RNPS feedback was also realized considering the effect of the external force to extend applications of the proposed soft robot.

A high-payload propriocepitve soft gripper   *May. 2019 - Mar. 2021*
- Proposed a novel POSA joint including multiple active actuators and a single passive actuator, with position and force proprioception. While generating higher grasping forces, proprioception could be achieved using the embedded cost-efficient air pressure sensors in the pneumatic control loop.
- Proposed a novel high-payload hybrid gripper based on the proposed joint, with two fingers and three degrees of freedom (DoF). It can realize one-DoF multimodal perception based on a single type of embedded pressure sensor.
- Conducted force and displacement proprioception experiments to validate the proposed model, realized proprioception-based position control for the hybrid gripper, as well as the recognition of objects with different sizes and weights.

Pneumatic soft robotic face system   *May. 2019 - Jun. 2022*
- Developed the overall pressure control system to drive the artificial face and image capture system to realize the face recognition. The proposed soft face can be implemented to increase the safety of the smart phone.
- Conducted the repeatability experiments, face space experiments and single channels feature experiments for the face.
- Analyzed the feature vectors extracted through the face recognition algorithm to verify the characteristics of the propose soft face.

Washing Machine in Space Station   *May. 2016 - Jul. 2017*
- Developed on-orbit cleaning technology in space station to separate gas and liquid under microgravity in the condition of saving water and energy.
- Proposed centrifugal cone-shaped two-phase washing machine and simulated interior flow field of the device with CFD.

Surface Tension Vaned Tank of Satellite Propellant   *Jun. 2015 - Dec. 2016*
- Designed a new structure of the satellite propellant tank and proposed the inner *Propellant Management Device* and its corresponding distribution mode.
- Conducted microgravity experiments of tank in drop tower and simulated the same cases to optimize its structure.
- Invited to participate in *Space Tea Cup in Shenzhou 11* and took charge of *drop-tower* experiments.

TianGong2 Space Laboratory (TG2) and ShiJian10 Satellite (SJ10)   *Jun. 2015 - Dec. 2016*

- Conducted electrical experiments and mechanical vibration experiments for *Liquid Bridge Subsystem* in TG2.
- Monitored the data of subsystem in TG2 in *Jiuquan Satellite Launch Center* and preliminarily analyzed the experiment results.
- Was responsible for electrical experiments and thermal balance experiments in NSSC, and monitored the data from SJ10.

PROFESSIONAL EXPERIENCE

Southern University of Science and Technology (SUSTech)   **Shenzhen, China**
👤 *Research assistant in MEE*   *Apr. 2019 - Aug. 2020*

- Proposed a high-payload hybrid robotic gripper based on the soft actuators, and submit the related paper and video in ICRA 2020. Also, displayed the gripper in *China hi tech fair (CHTF)*, 2018.
- Designed kinematic model and a dedicated experiment platform and control system for the proposed gripper.
- Built the dual-arm robotic experiment platform for *Biorobotic and Control Lab*, where tested the proposed prototype of Clinical Breast Examinations robot.

The Chinese University of Hong Kong (CUHK)   **Hong Kong, China**
👤 *Research assistant in MAE*   *Oct. 2018 - Apr. 2019*

- Simulated the task with QP controller and tuned the priorities of sub-tasks based on completeness of tasks automatically for open-door task through 6-DOFs arm, .
- Conducted the open-door experiment in UR5 arm and verified the proposed control strategy in real environment.

The Chinese University of Hong Kong, Shenzhen (CUHKSZ)   **Shenzhen, China**
👤 *Research engineer in Institute of Robotics and Intelligent Manufacturing*   *Dec. 2017 - Sept. 2018*

- Built a robotic team (IRIM-Solver) to participate in *2018 JDX Robotics Challenge*. As team leader, was in charge of team cooperation, daily management and the overall design of robotic system, and implemented grasp system and vision system. At last, the team reached the final competition and was awarded **RMB 100,000. (10 final teams in the world)**.
- Proposed a control algorithm based on *Quadratic Programming* and *Bayesian Optimization* to tune the priority of multi-task controller automatically in project **Design, control and Scheduling of Logistical Service Robots in Complicated Environments** supported by *NSFC*.
- Wrote and applied the project **Research on Key Technologies of Heterogeneous Logistics Robot System Based on Integration of Human, Robot and Environment (RMB 3,000,000)** supported by *Shenzhen Science and Technology Innovation Committee*.

China General Nuclear Research Institute Co., Ltd. (CGN)   **Shenzhen, China**
👤 *Assistant engineer*   *Jul. 2017 - Dec. 2017*

- Conducted research, especially fluid simulation, on fluid-structure coupling of **anti-sloshing design of liquid tank in marine nuclear reactor** supported by *CGN*.

ACHIEVEMENTS & AWARDS

- Honorable Mention in the 2018 JRX ROBOTICS CHALLENGE (RMB 100,000)   *Dec. 2018*
- National Xu Zhilun Outstanding Students Award (2 Candidates/province)   *Nov. 2014*
- Outstanding Graduates (NEU)   *May. 2014*
- National Scholarship   *Nov. 2013*
- Honorable Mention in Mathematical Contest in Modeling   *Mar. 2013*
- National Scholarship for Encouragement   *Nov. 2012*
- The First Prize Scholarship (NEU)   *Two times*
- The Second Prize Scholarship (NEU)   *Three times*

SKILLS

- **Programming:** C++, Python, Matlab, Qt
- **Language:** Mandarin (native), English (working language).