

Shuyuan Wang

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Education Background

Sept. 2018 - July. 2022	Southern University of Science and Technology (SUSTech) Department of Mechanical and Energy Engineering Bachelor in Robotics Engineering	3.76 / 4.00
Jun. 2021 - Sept. 2021	Tsinghua University (THU) Department of Mechanical Engineering Visiting Student	
Sept. 2022 - present	Johns Hopkins University (JHU) Department of Mechanical Engineering Master Student	

Research Interests

Humanoid Robot, Deep Learning, Soft Robot, Electrostatic Adhesion, Advanced Actuation, Exoskeleton, Body Augmentation, Legged Locomotion, Motion Control, Human-Machine Interaction

Research Experiences (4+)

A Stretchable, Flexible, Robust Electrostatic Adhesion Device

Sept. 2019 - present

Advisor: Prof. Hongqiang Wang

Low adsorption efficiency and easy damage to electrodes in harsh environments have restricted the general use of robots. A new type of super-deformation and self-healing electrostatic adhesion device is proposed. The combination of easy-to-stretch soft material, flowable fluid electrode, and alternating interdigital structure ensure safe and reliable human-machine interaction in unpredictable environments.

- **Mechanical Design:** Designed an alternating structure, including soft material and fluid electrodes, and enhanced soft robots with the advanced actuator technology.
- **Self-healing Mechanism:** Developed a self-healing strategy that can recover the adhesion capacity during physical penetration and high-voltage short circuit.
- **Fabrication Process:** Used 3D-printing and photocuring technology to complete a mature processing technic.
- **System Modeling:** Utilized finite element simulation software to corroborate the electrostatic model.

Deep Learning on Point Cloud of Aerospace Components for 3D Classification

Jun. 2021 - Sept. 2021

Advisor: Prof. Yiming Rong Prof. Gang Wang Prof. Zhenguo Nie

The cost of heat treatment processes was high due to the trial-and-error methods on design and optimization. In order to significantly reduce the number of personnel workloads, we designed an approximate matching neural network with existing components through independent identification of the geometric characteristics. Components of space launch vehicles were recognized and paired with the most similar process automatically through deep learning.

- **Classification Algorithm:** Developed a 3D classification method based on point cloud and Convolutional Neural Network (CNN), which achieved a test accuracy of 96.88%.
- **Dataset Supplement:** Created a 3D aerospace components dataset from collected SLDPRT models and continuously updated the dataset.

- **Network Optimization:** Optimized the neural network with residual learning framework (ResNet) and gained accuracy from considerably increased depth.

Origami-Inspired Soft Pneumatic Actuating Robot

Mar. 2021 - May 2021

Advisor: Prof. Hongqiang Wang 

The IEEE RoboSoft 2021 Conference, hosted by Yale University, aimed to promote resilience, adaptability, system integration, and energy independence of the state-of-the-art soft robot. An obstacle course with fall, slope, terrain, and gap sections was designed to showcase the capabilities of the soft robot. We presented a soft pneumatic actuating robot of strong robustness, high speed, and multi-terrain adaptation that was inspired by origami.

- **Bionic Design:** Developed a bionic cat tongue papillae structure to provide forward friction for robot locomotion ignoring terrain restrictions.
- **Mechanical Design:** Developed a stretchable four-origami-leg system that enabled the robot to pass through gaps.
- **Pneumatic Control:** Utilized embedded system to control the pressure in each leg. Applied the control algorithm to automatically achieve a gait circle.

A Bionic Hierarchical Electrostatic Adhesion Robot “Cell”

Sept. 2020 - Jan. 2021

Advisor: Prof. Hongqiang Wang 

Based on the mechanism of electrostatic adhesion, “Cell” used the contraction and expansion of units to simulate the turgor movement of plant cells. The arrangement and interaction between “Cell” groups resembled the hierarchical structure inside plants and drove the soft robot to realize the integrated design of movement, perception, and control.

- **Bionic Design:** Developed the “Cell” units and groups to reproduce the hierarchical structures of plants, i.e., cells, tissues, and organisms.
- **Mechanical Design:** Applied “Cell” to some mechanical structures, and realized control not only on macroscopic tissues, but also microscopic cells.

Participated Projects (in chronological order)

A Mars Rover and Corresponding Beach Planetary Rover Dataset	<i>Nov. 2021 – Jan. 2022</i>
A Vector Bending Monitor Based on 45° Tilted Fiber Grating	<i>May 2021 - July. 2022</i>
Robot Handling Process Based on Machine Vision and Path Planning	<i>May 2021 - Jun. 2021</i>
Design, Manufacture, and Analysis of an Eight-Leg Crab Robot	<i>Mar. 2021 - Jun. 2021</i>
MRI-compatible Intelligent Robot System for Breast Biopsy	<i>Mar. 2021 - Jun. 2021</i>
Adaptive Matrix Multiplication Based on Strassen’s Method	<i>Dec. 2020 - Jan. 2021</i>
Self-propelled Trolley Robot Processed by Computer Numerical Control (CNC)	<i>Nov. 2020 - Jan. 2021</i>
Modeling and Control of a 7-DoF KUKA Machine Arm	<i>Nov. 2020 - Jan. 2021</i>

Honors (24)

Scholarships

2021	<ul style="list-style-type: none"> • First Class of the Merit Student Scholarship (<i>Top 2% at SUSTech</i>) • Excellent Student Service Scholarship (<i>Top 5 of 150 Students</i>)
2020	<ul style="list-style-type: none"> • Progress Scholarship • Advanced Sports Team Scholarship
2019	<ul style="list-style-type: none"> • Excellent Student Service Scholarship (<i>Top 5 of 150 Students</i>) • Popular Class Scholarship

- Advanced Sports Team Scholarship
- Third Class of the Merit Student Scholarship (*Top 10% at SUSTech*)

Honors

- 2022 • Outstanding Graduate Award of Southern University of Science and Technology
- 2021 • IEEE RoboSoft 2021 Locomotion Competition Winner
- "Challenge Cup" College Student Curricular Academic Science and Technology Works Competition Best Paper Award (*Top 10% at SUSTech*)
- Project Exhibition of Department of Mechanical and Energy Engineering Outstanding Award (*Top 3 of 113 teams*)
- Project Exhibition of Department of Mechanical and Energy Engineering Second Prize Award (*Top 20 of 113 teams*)
- College Basketball Tournament Championship
- 2020 • Excellent Class Service (*Top 7 of 1050 Students*)
- College Basketball Tournament Runner-Up
- 2019 • Excellent Youth Student (*Top 5% at SUSTech*)
- Outstanding Intern of Advanced Actuators & Robotics Lab
- College Basketball Tournament Championship
- College Basketball Tournament Third Runner-Up
- College Drama Contest Third Prize Award
- 2018 • Best Volunteer Award of SUSTech Emergency Rescue Association
- Best Freshman Award
- 31 Volunteer Hours
- Class President (2018 - 2022)

Academic Achievements (4)

- Funding**
 - National Undergraduate Training Program for Innovation and Entrepreneurship (202114325012): *Self-healing Mechanism of the Soft Electrostatic Adhesion Actuator*. PI: **Shuyuan Wang**. Time: 2021 – 2022.
 - “Climbing Program” Special Funds for the Cultivation of Guangdong Province College Students’ Scientific and Technological Innovation Special Funds (pdjh2021c0044): *Mechanism and Processing Method of Stretchable Soft Electrostatic Adhesion Unit*. PI: **Shuyuan Wang**. Time: 2020 – 2022.
 - Collegial Undergraduate Training Program for Innovation and Entrepreneurship (2021X17): *In-Fiber Mach-Zehnder Interferometer Based on Er Doped Up-Taper and Peanut-Shaped Fiber Structure in Fiber Ring Laser*. PI: Shengjie Zhou. Time: 2021 – 2022.
- Publication**
 - Fu, Y., **Wang, S.**, Fan, D., & Wang, H. (2019). A Soft and Robust Electroadhesive Device. *In Proceedings of the 7th International Conference on Smart Materials and Nanotechnology in Engineering* [🔗](#)

Skills

Theoretical Basis

Solid Foundation: Soft Robot, Advanced Actuation, Machine Learning, Control Theory

A Certain Understanding: Robot Operation System, Embedded System, Sensing Technology, Data Structure

Laboratory Experience

Mechanical Design and Fabrication, Neural Network Architecture, Mechanics Experiments, Presentation, Control

Algorithm, Parameter Tuning, etc.

Software Skills

Language: Java, Python, C, C++, HTML

Engineering Programming: MATLAB & Simulink, LabVIEW, Arduino, Keil uVision

Mechanical Design: SOLIDWORKS, AutoCAD, ADAMS, 3D Print, Photocuring

Machine Learning: PyTorch, TensorFlow

Simulation: COMSOL, CoppeliaSim (V-REP), Gazebo, Rviz, Drake

Visualization: Origin, Adobe Illustrator, Adobe Premiere, PowerPoint