

# JIEFENG SUN

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## RESEARCH

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- **Bio-inspired Robot Design:** Artificial Muscles; Soft Robots; Reconfigurable Robots;
- **Modeling and Control:** Rigid/Continuum Robot Dynamics; Machine Learning based Modeling and Control;

## EDUCATION

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### Ph.D. Robotics and Control

Expected **July 2022**

*Colorado State University*

*Fort Collins, USA*

Dissertation: Soft and Shape Morphing Robots Driven by Twisted-and-Coiled Actuators

Advisor: Jianguo Zhao

### M.S. Mechanical Engineering

**June 2017**

*Dalian University of Technology*

*Dalian, China*

Thesis: Dynamic Simulation of a Nuclear Polar Crane with a Seismic Isolation Device

Advisor: Fuzheng Qu

### B.S. Mechanical Engineering (with highest honor)

**June 2014**

*Lanzhou University of Technology*

*Lanzhou, China*

## HONOR AND SELECTED AWARDS

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### DARPA Riser

**2022**

Defense Advanced Research Projects Agency

### IOP Reviewer of the Year 2021 Award

**2022**

Smart Materials and Structures Journal

### ACC Traveling Award

**2022**

### ICRA Traveling Award

**2022**

### CSU Traveling Award for International Conferences

**2019, 2022**

### Finalist, Best Student Paper Award

**2018**

International Conference on Intelligent Robots and Systems (IROS) (**Top 6 over 2,700**)

### Scott Inaugural Graduate Fellowship

**2017**

Walter Scott, Jr. College of Engineering, CSU

## PUBLICATIONS

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### Journal Articles

1. H. Hsiao, **J. Sun**, H. Zhang, and J. Zhao, “A mechanically intelligent and passive gripper for aerial perching and grasping,” *IEEE/ASME Transactions on Mechatronics (Accepted)*, 2022
2. **J. Sun** and J. Zhao, “Physics-based modeling of twisted-and-coiled actuators using cosserat rod theory,” *IEEE Transactions on Robotics*, vol. 38, no. 2, pp. 779–796, 2022 [\[PDF\]](#)
3. **J. Sun**, B. Tighe, Y. Liu, and J. Zhao, “Twisted-and-coiled actuators with free strokes enable soft robots with programmable motions,” *Soft Robotics*, vol. 8, no. 2, pp. 213–225, 2021 [\[PDF\]](#)
4. Y. Tang, Y. Chi, **J. Sun**, T.-H. Huang, O. H. Maghsoudi, A. Spence, J. Zhao, H. Su, and J. Yin, “Leveraging elastic instabilities for amplified performance: Spine-inspired high-speed and high-force soft robots,” *Science Advances*, vol. 6, no. 19, p. eaaz6912, 2020 [\[PDF\]](#)
5. **J. Sun** and J. Zhao, “An adaptive walking robot with reconfigurable mechanisms using shape morphing joints,” *IEEE Robotics and Automation Letters (RAL)*, vol. 4, no. 2, pp. 724–731, 2019 [\[PDF\]](#)
6. B. Pawlowski, **J. Sun**, J. Xu, Y. Liu, and J. Zhao, “Modeling of soft robots actuated by twisted-and-coiled actuators,” *IEEE/ASME Transactions on Mechatronics*, vol. 24, no. 1, pp. 5–15, 2018 [\[PDF\]](#)

### Under Publication

1. W. Wang<sup>†</sup>, **J. Sun**<sup>†</sup>, S. Vallabhuneni, B. Pawlowski, H. Vahabi, K. Nellenbach, A. C. Brown, F. Scholle, J. Zhao\*, and A. K. Kota\*, “On-demand, remote and lossless manipulation of biofluid droplets,” *Science Advances (Submitted)*, 2022 (<sup>†</sup> Co-first author)
2. **J. Sun**, E. Lerner, B. Tighe, and J. Zhao, “Embedded and versatile shape-morphing structures enabled adaptive robots,” *Science Robotics (To be submitted)*, 2022

### Conference Proceedings

1. H. Hsiao, F. Wu, **J. Sun**, and J. Zhao, “A novel passive mechanism for flying robots to perch onto surfaces,” in *2022 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE, 2022, p. Accepted [\[PDF\]](#)
2. **J. Sun** and J. Zhao, “Modeling and simulation of soft robots driven by artificial muscles: an example using twisted-and-coiled actuators,” in *2022 American Control Conference (ACC)*. IEEE, Invited Paper, Accepted [\[PDF\]](#)
3. **J. Sun**, B. Tighe, and J. Zhao, “Tuning the energy landscape of soft robots for fast and strong motion,” in *2020 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE, 2020, pp. 10 082–10 088 [\[PDF\]](#)

4. **J. Sun** and J. Zhao, “Integrated actuation and self-sensing for twisted-and-coiled actuators with applications to innervated soft robots,” in *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE, 2020, pp. 8795–8800 [\[PDF\]](#)
5. H. Zhang, **J. Sun**, and J. Zhao, “Compliant bistable gripper for aerial perching and grasping,” in *2019 International Conference on Robotics and Automation (ICRA)*. IEEE, 2019, pp. 1248–1253 [\[PDF\]](#)
6. **J. Sun**, B. Pawlowski, and J. Zhao, “Soft manipulators with programmable motion using twisted-and-coiled actuators (conference presentation),” in *Electroactive Polymer Actuators and Devices (EAPAD) XXI*, vol. 10966. International Society for Optics and Photonics (SPIE), 2019, p. 109660Q [\[PDF\]](#) [\[Video\]](#)
7. B. Pawlowski, **J. Sun**, and J. Zhao, “Dynamic modeling of soft manipulators actuated by twisted-and-coiled actuators,” in *2018 IEEE Conference on Decision and Control (CDC)*. IEEE, 2018, pp. 409–414 [\[PDF\]](#)
8. **J. Sun**, B. Pawlowski, and J. Zhao, “Embedded and controllable shape morphing with twisted-and-coiled actuators,” in *2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE, 2018, pp. 5912–5917 [\[Best Student Paper Award Finalist\]](#) [\[PDF\]](#)

## Patents

1. H. Zhang, J. Zhao, and **S. Jiefeng**, “Compliant bistable gripper for aerial perching and grasping,” Sep. 29 2020, **US Patent** 10,787,259 [\[PDF\]](#)
2. F. Qu, T. Sun, and **S. Jiefeng**, “An experimental crane for college labs,” Sep. 2017, issued by National Intellectual Property Administration, PRC. CN ZL201510528289.9

## PRESENTATION AND INVITED TALKS

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1. A Mechanically Intelligent and Passive Gripper for Aerial Perching and Grasping. 2nd International Conference on Embodied Intelligence. Mar 2022.
2. Bioinspired robots driven artificial muscles. *BMES faculty research panel*, talk for students in biomedical engineering, Colorado State University. Nov 2021.
3. Integrated actuation and self-sensing for twisted-and-coiled actuators with applications to innervated soft robots. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). Virtual. Oct 2020.
4. Tuning the energy landscape of soft robots for fast and strong motion. IEEE International Conference on Robotics and Automation (ICRA). Virtual. May 2020.
5. Versatile and controllable shape morphing using twisted-and-coiled actuators. *APS March Meeting*. Denver, USA. March 2020.
6. Soft manipulators with programmable motion using twisted-and-coiled actuators. *SPIE: Electroactive Polymer Actuators and Devices (EAPAD) XXIV conferences*. Denver, USA. May 2019.

7. An adaptive walking robot with reconfigurable mechanisms using shape morphing joints. IEEE International Conference on Robotics and Automation (*ICRA*). Montreal, Canada. May 2019.

## MEDIA COVERAGE (SELECTED)

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1. **IEEE Spectrum:** [Robot Melts Its Bones to Change How It Walks](#). (02/12/2019)
2. **TechXplore:** [Shape-morphing joints allow these small robots to ace obstacles](#) (02/20/2019)
3. **Futurism:** [See a Robot Melt its Own Bones To Avoid Obstacles: That's Pretty Metal](#) (02/13/19)
4. **HighTechdeck:** [Adaptive Robot Melts & Solidifies Its Bones on the Fly to Avoid Obstacles](#) (02/13/2019)
5. **Science Daily:** [Inspired by cheetahs, researchers build fastest soft robots yet](#). (05/08/2020)
6. **Engadget:** [Soft robots can now run like cheetahs and swim like marlins](#) (05/08/2020)
7. **TechXplore:** [Artificial muscle made of sewing thread enables new motions for soft robots](#) (07/13/2020)
8. **Phys.org:** [These robots are small, shape-shifting, and they adapt to their surroundings](#). (03/06/2019)

## PROFESSIONAL ACTIVITIES

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**Reviewer** (Reviewed over 50 times from the following)

### Journals:

IEEE Transactions on Robotics (T-RO)  
IEEE/ASME Transactions on Mechatronics (T-Mech)  
Bioinspiration & Biomimetics (B&B)  
Smart Materials and Structures (**Reviewer of the Year Award, 2021**)  
Sensors and Actuators: A. Physical  
IEEE/RSJ Robotics and Automation Letters (RA-L)  
IEEE Access  
International Journal of Precision Engineering and Manufacturing

### International Conferences:

IEEE/RSJ International Conference on Robotics and Automation (ICRA) 2018-  
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2019-  
IEEE/ASME International Conference on Advanced Intelligent Mechatronics(AIM) 2018-  
American Control Conference (ACC) 2021-  
IEEE International Conference on Soft Robotics (RoboSoft) 2019-

## PROPOSAL DRAFTING EXPERIENCE

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1. Drafted a grant proposal for Prof. Jianguo Zhao: Embedded and Continuous Shape Morphing using Twisted-and-Coiled Artificial Muscle. **National Science Foundation, CRII: RI.** Status: funded, 2018.
2. Drafted a grant proposal for Prof. Jianguo Zhao: Adaptive, Rapid, and Multifunctional Soft Robots (ARM SoRo) with Reconfigurable Shapes and Motions Enabled by Tunable Elastic Instabilities. **National Science Foundation, CMMI.** Status: funded, 2021.

## TEACHING EXPERIENCE

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- **Co-instructor** - *Colorado State University*  
MECH 564: Fundamentals of Robot Mechanics and Controls. **Developed and taught new robot simulation labs for the class** [\[Link\]](#). Spring, 2022.  
MECH 568: Bio-inspired Robotics. Taught lectures about soft robots and models. Fall, 2021.
- **Teaching Assistant** - *Colorado State University*  
MECH 564: Fundamentals of Robot Mechanics and Controls. Spring, 2021.

## STUDENTS SUPERVISION

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<b>Clint Middlemist</b> <i>Undergraduate Student</i> Research Topic: An Adaptive Shape Morphing Gripper	Jan 2021 – Now <i>Mechanical Engineering, CSU</i>
<b>Feiyu Wu</b> <i>High School Student</i> Research Topic: Bistable Perching Mechanisms for Flying Robots	Aug 2020 – Now <i>Rocky Mountain High School</i>
<b>Sydney Spiegel</b> <i>Undergraduate Student</i> Research Topic: Tensegrity Robots by Twisted-and-Coiled Actuators	Aug 2019 - Now <i>Mechanical Engineering, CSU</i>
<b>Ajai Singh</b> <i>Graduate Student</i> Research Topic: Learning-based Dynamics Modeling of Soft Robots driven by TCAs	Aug 2021 - Now <i>Electrical Engineering, CSU</i>
<b>Jolan von Plutzner</b> <i>Undergraduate Student</i> Research Topic: A Soft 3-way Bending Robotic Finger	Jan 2018 – Mar 2018 <i>Mechanical Engineering, Duke Univ.</i>
<b>Jeff Larchar</b> <i>Undergraduate Student</i> Research Topic: Robotic Fish driven by Artificial muscles	Jan 2017 – Aug 2018 <i>Mechanical Engineering, CSU</i>
<b>Brandon Tighe</b> <i>Undergraduate and Graduate</i> Research Topic: Shape Morphing Robots Driven by Twisted-and-Coiled Actuators	Jun 2018 – May 2022 <i>Mechanical Engineering, CSU</i>

## REFERENCES

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- **Dr. Jianguo Zhao** (PhD Advisor)

Associate Professor

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Professor and Head

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- **Dr. Jie Yin**

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- **Dr. Wei Wang**

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More References are available upon request.

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