

# 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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### IOP Reviewer of the Year 2021 Award

**2022**

Smart Materials and Structures Journal

### 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. Vallabhuni, 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)

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## PROFESSIONAL ACTIVITIES

### 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-

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## PROPOSAL DRAFTING EXPERIENCE

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.

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## TEACHING EXPERIENCE

- **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 Rocky Mountain High School
<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**

Assistant Professor

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More References are available upon request.

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