

JIEFENG SUN

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RESEARCH

- Robotics
 - Biologically inspired robotics (manipulation and locomotion)
 - Mechatronics (mechanical design and embedded systems)
 - Artificial muscles
 - Robotics for medical applications
- Control
 - Dynamics modeling and control for robotic systems
 - Machine learning based modeling and control
 - Vision based control or visual servoing

EDUCATION

Ph.D.in 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. in Mechanical Engineering (with highest honor)

June 2014

Lanzhou University of Technology

Lanzhou, China

Thesis: Design of an Experimental Crane for College Labs (Patented)

Advisor: Fuzheng Qu

HONOR AND AWARD

Finalist, Best Student Paper Award

2018

International Conference on Intelligent Robots and Systems (IROS)

- Among the 6 selected from 2,700 paper submissions from 62 countries

Scott Inaugural Graduate Fellowship

2017

Walter Scott, Jr. College of Engineering, CSU

PUBLICATIONS

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*, Under Revision
2. **J. Sun** and J. Zhao, “Physics-based modeling of twisted-and-coiled actuators using cosserat rod theory,” *IEEE Transactions on Robotics*, 2021
3. 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
4. **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
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
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

Conference Proceedings

1. **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, Under Review, Invited Paper
2. **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
3. **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
4. 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
5. **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
6. 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

7. **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**]

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
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

1. Bioinspired robots driven artificial muscles. *BMES faculty research panel*, talk for students in biomedical engineering, Colorado State University. Nov 2021.
2. 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.
3. Tuning the energy landscape of soft robots for fast and strong motion. IEEE International Conference on Robotics and Automation (*ICRA*). Virtual. May 2020.
4. Versatile and controllable shape morphing using twisted-and-coiled actuators. *APS March Meeting*. Denver, USA. March 2020.
5. Soft manipulators with programmable motion using twisted-and-coiled actuators. *SPIE: Electroactive Polymer Actuators and Devices (EAPAD) XXIV conferences*. Denver, USA. May 2019.
6. 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

1. **IEEE Spectrum**: Robot Melts Its Bones to Change How It Walks. (02/12/2019) <https://spectrum.ieee.org/robot-melts-its-bones-to-change-how-it-walks>
2. **TechXplore**: Shape-morphing joints allow these small robots to ace obstacles <https://techxplore.com/news/2019-02-shape-morphing-joints-small-robots-ace.html>
3. **Futurism**: See a Robot Melt its Own Bones To Avoid Obstacles: That’s Pretty Metal (02/13/19) <https://futurism.com/the-byte/robot-melt-bones-avoid-obstacles>
4. **HighTechdeck** Adaptive Robot Melts & Solidifies Its Bones On The Fly To Avoid Obstacles (02/13/2019) <https://hightechdeck.com/adaptive-robot-melts-solidifies-its-bones-on-the-fly-to-avoid-obstacles>

5. **Science Daily:** Inspired by cheetahs, researchers build fastest soft robots yet. (05/08/2020) <https://www.sciencedaily.com/releases/2020/05/200508145329.htm>
6. **Engadget:** Soft robots can now run like cheetahs and swim like marlins (05/08/2020) <https://www.engadget.com/soft-cheetah-robot-flexible-spine-ncsu-180005178.html>
7. **TechXplore** Artificial muscle made of sewing thread enables new motions for soft robots (07/13/2020) <https://techxplore.com/news/2020-07-artificial-muscle-thread-enables-motions.html>
8. **CSU Source** Artificial muscle made of sewing thread enables new motions for soft robots (07/08/2020) <https://engr.source.colstate.edu/soft-robots-can-flex-artificial-muscles-made-from-sewing-thread/>
9. **EctronicDesign:** Coiled Conductive-Thread Actuators Eerily Emulate Muscle Motion. (11/12/2020) <https://www.electronicdesign.com/industrial-automation/article/21147106/electronic-design-coiled-conductivethread-actuators-eerily-emulate-muscle-motion>
10. **Phys.org:** These robots are small, shape-shifting, and they adapt to their surroundings. (03/06/2019) <https://phys.org/news/2019-03-robots-small-shape-shifting.html>

PROFESSIONAL ACTIVITIES

Reviewer

Journals:

IEEE/ASME Transactions on Mechatronics (T-Mech)
 Bioinspiration & Biomimetics (B&B)
 Smart Materials and Structures
 Sensors and Actuators: A. Physical
 IEEE/RSJ Robotics and Automation Letters (RA-L)
 IEEE Access

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-

GRANT WRITING EXPERIENCE

1. Wrote a draft grant for Prof. Jianguo Zhao: Embedded and Continuous Shape Morphing using Twisted-and-Coiled Artificial Muscle. **National Science Foundation, CRII: RI.** Status: funded, 2018.

2. Wrote a draft grant with Prof. Jianguo Zhao: LEAP SoRo: Leveraging Elastic instabilities for Amplified Performance Soft Robots: fast, strong, and energy-efficient. **National Science Foundation, EFRI C3 SoRo**. Status: Unfunded, 2020.

TEACHING EXPERIENCE

Teaching Assistant	MECH 564: Fundamentals of Robot Mechanics and Controls, Spring, 2021.
Guest Lecturer	MECH 568: Bio-inspired Robotics, Fall, 2021.

STUDENTS SUPERVISION

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

REFERENCES

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

Associate Professor

Department of Mechanical Engineering, Colorado State University

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- **Dr. Anthony A. Maciejewski**

Professor and Head

Department of Electrical and Computer Engineering, Colorado State University

Address: B104 Engineering Building, Fort Collins, CO 80523-1373

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- **Dr. Jie Yin**

Associate Professor

Department of Mechanical and Aerospace Engineering, North Carolina State University

Address: EB3 RM 3240, 1840 Entrepreneur Drive, Raleigh, NC 27695

Tel: (919)515-7030

Email: jyin8@ncsu.edu

- **Dr. Wei Wang**

Assistant Professor

Department of Mechanical, Aerospace, and Biomedical Engineering, University of Tennessee

Address: 310 Dougherty Engineering Bldg. 1512 Middle Drive Knoxville, TN 37996

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More References are available upon request.

Updated 12/10/2021