

JIEFENG SUN

Colorado State University, Fort Collins, CO 80524, USA

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RESEARCH

- **Robot Design:** Artificial Muscles; Soft Robots; Reconfigurable Robots;
- **Modeling and Control:** Physics-based Robot Modeling; Machine Learning -based Modeling and Control; Control Co-optimization; Human-Robot Interaction;

EDUCATION

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: Prof. 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: Prof. Fuzheng Qu

B.S. Mechanical Engineering (with distinction)

June 2014

Lanzhou University of Technology

Lanzhou, China

HONOR AND SELECTED AWARDS

DARPA Riser (Class of 2022)

2022

Defense Advanced Research Projects Agency, USA

Reviewer of the Year 2021 Award

2022

Smart Materials and Structures Journal, IOP

ICRA Traveling Award, ACC 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

Third Prize in National 3D Innovative Design Competition, China

2012

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 (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[†], **J. Sun**[†], 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 ([†] 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

PROPOSAL DRAFTING EXPERIENCE

1. Drafted a grant proposal led by Prof. Jianguo Zhao: Embedded and Continuous Shape Morphing using Twisted-and-Coiled Artificial Muscle. **National Science Foundation, CRII: RI (\$0.2M). Status: funded, 2018.** I provided 80% preliminary results and drafted 30% of the proposal.
2. Drafted a grant proposal led by Prof. Jianguo Zhao and Prof. Jie Yin: Adaptive, Rapid, and Multifunctional Soft Robots (ARM SoRo) with Reconfigurable Shapes and Motions Enabled by Tunable Elastic Instabilities. **National Science Foundation, CMMI. (\$0.7M). Status: funded, 2021.** I provided 50% preliminary results and drafted 25% of the proposal.
3. In preparation: drafting a proposal as a CO-PI (led by Prof. Jianguo Zhao): Mechanical and Control Co-design of Soft Robots driven by Artificial Muscles. **National Science Foundation, FRR.(\$0.5M).** I am drafting the whole proposal under the supervision of Prof. Jianguo Zhao.

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, 2020, 2021.

PRESENTATION AND INVITED TALKS

1. Modeling and simulation of soft robots driven by artificial muscles. 2022 American Control Conference. Atlanta, USA. June 2022.
2. Physics-based modeling of twisted-and-coiled actuators using Cosserat rod theory. IEEE International Conference on Robotics and Automation (*ICRA*). Philadelphia, USA. May 2022.
3. A Mechanically Intelligent and Passive Gripper for Aerial Perching and Grasping. 2nd International Conference on Embodied Intelligence. Virtual. Mar 2022.
4. Bioinspired robots driven artificial muscles. *BMES faculty research panel*, talk for students in biomedical engineering, Colorado State University. Nov 2021.
5. 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.
6. Versatile and controllable shape morphing using twisted-and-coiled actuators. *APS March Meeting*. Denver, USA. March 2020.
7. Soft manipulators with programmable motion using twisted-and-coiled actuators. *SPIE: Electroactive Polymer Actuators and Devices (EAPAD) XXIV conferences*. Denver, USA. May 2019.
8. 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)

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

Reviewer (Reviewed 50+ papers from 15 Journals and international conferences.)

Journals

- IEEE Transactions on Robotics (T-RO); IEEE/ASME Transactions on Mechatronics (T-Mech); Bioinspiration & Biomimetics (B&B); Smart Materials and Structures (SMS) ; Sensors and Actuators: A. Physical (SNA); IEEE/RSJ Robotics and Automation Letters (RA-L); IEEE Transactions on Industrial Electronics (T-IE); 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-

STUDENTS SUPERVISION

Clint Middlemist

Jan 2021 – Now

Undergraduate Student

Mechanical Engineering, CSU

Research Topic: An Adaptive Shape Morphing Gripper

Feiyu Wu

Aug 2020 – Now

High School Student

Rocky Mountain High School

Research Topic: Bistable Perching Mechanisms for Flying Robots

Sydney Spiegel

Aug 2019 - Now

Undergraduate Student

Mechanical Engineering, CSU

Research Topic: Tensegrity Robots by Twisted-and-Coiled Actuators

Jolan von Plutzner

Jan 2018 – Mar 2018

Undergraduate Student

Mechanical Engineering, Duke Univ.

Research Topic: A Soft 3-way Bending Robotic Finger

Jeff Larchar

Jan 2017 – Aug 2018

Undergraduate Student

Mechanical Engineering, CSU

Research Topic: Robotic Fish driven by Artificial muscles

Brandon Tighe

Jun 2018 – May 2022

Undergraduate and Graduate

Mechanical Engineering, CSU

Research Topic: Shape Morphing Robots Driven by Twisted-and-Coiled Actuators

REFERENCES

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

Associate Professor

Department of Mechanical Engineering, Colorado State University

Address: RM 220, 430 N College Ave, Fort Collins, CO 80524

Tel: (970)491-5927

Email: jianguo.zhao@colostate.edu

- **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

Tel: (970)491-6600

Email: aam@colostate.edu

- **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

Tel: (865)974-9376

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More References are available upon request.

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