Jun Zhang

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Department of Mechanical Engineering
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RESEARCH INTERESTS

- Smart materials and artificial muscles for intelligent systems including biomimetic robots, soft robots, assistive robots, and microelectromechanical systems

- Analysis and development of mechatronic and robotic systems with high fidelity and low complexity solutions

Relevant disciplines: Control systems, robotics, artificial muscles, smart materials, mechatronics

EDUCATION

Ph.D., Electrical and Computer Engineering   2015/12
Michigan State University, East Lansing, MI
Thesis: *Modeling, identification, and control of hysteretic systems with application to vanadium dioxide microactuators*
Advisor: Xiaobo Tan
Outstanding Graduate Student in Electrical Engineering

B.S., Automation   2011/06
University of Science and Technology of China, Hefei, Anhui, China

ACADEMIC APPOINTMENTS

Assistant Professor   2018/08 - present
Department of Mechanical Engineering
University of Nevada, Reno, NV

Postdoctoral Scholar   2016/01 - 2018/08
Department of Electrical and Computer Engineering
University of California San Diego, La Jolla, CA
Mentor: Michael C. Yip

Research Intern   2010/06 - 2010/08
Department of Electrical Engineering
Pohang University of Science and Technology, Pohang, South Korea
Mentor: Sangchul Won

HONORS

1. Student Awards

- **Nevada Undergraduate Research Award** (with Aaron Wiese), for proposal on active cooling system for artificial muscles, 2018
- **Nevada Undergraduate Research Award** (with David Bombara), for proposal on artificial muscle-powered humanoid robot hand, 2018

2. **Third Place, Best Oral Presentation**, 4th Annual Postdoctoral Research Symposium, University of California San Diego, 2016

3. **Dissertation Completion Fellowship**, Michigan State University, 2015

4. **Outstanding Graduate Student**, Electrical Engineering, Michigan State University, 2015

5. **Student Leadership Award**: Honorable Mention in the Category of Internationalizing the Student Experience, Michigan State University, 2014

6. **Best Conference Paper in Applications Award** (with E. Merced, N. Sepúlveda, and X. Tan), 2013 ASME Dynamic Systems and Control Conference (DSCC 2013), for paper "Optimal compression of a generalized Prandtl-Ishlinskii operator in hysteresis modeling"

7. **Finalist, Best Conference Paper Award** (with E. Merced, X, Tan and N. Sepúlveda), 2013 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM 2013), for paper "Robust control of VO_2-coated microactuators based on self-sensing feedback"

8. **Student Best Paper Competition Award**, 2012 ASME Conference on Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS 2012), for paper "Modeling of non-monotonic hysteresis behavior in VO_2-based MEMS actuators."

9. **Summer Graduate Excellence Fellowship**, Electrical and Computer Engineering, Michigan State University, 2013

RESEARCH AND EDUCATIONAL GRANTS

1. Senior personnel, "RET Site: REU Site: Biomimetic and Soft Robotics (BioSoRo): from Biological Inspirations to Engineered Mechanisms," National Science Foundation, $491,713, 4/1/2019 - 3/31/2022 (PI: W. Shan; Co-PI: Y. Shen; J. Hoy; 5 other senior personnel)

JOURNAL PUBLICATIONS

[J1] W. Kuang, M. C. Yip, and **J. Zhang**, "Vibration-based force transduction: A novel multi-axis force sensing moduality," *Sensors and Actuators A: Physical*, under review

[J2] **J. Zhang**, J. Sheng, C. O'Neill, C. J. Walsh, R. J. Wood, J-H. Ryu, J. P. Desai and M. C. Yip, "Robotic artificial muscles: Current progress and future perspectives for biomimetic actuators," *IEEE Transactions on Robotics*, DOI:10.1109/TRO.2019.2894371, to appear

[J3] D. Torres*, **J. Zhang***, S. Dooley, X. Tan, N. Sepúlveda, "Hysteresis-based mechanical state programming of MEMS mirrors," *Journal of Microelectromechanical Systems*, vol. 27, no. 2, pp. 344-354, 2018 (* equal contributions)

[J4] A. Simeonov, T. Henderson, Z. Lan, G. Sundar, A. Factor, **J. Zhang** and M. C. Yip, "Bundled super-coiled polymer artificial muscles: Design, characterization, and modeling," *IEEE Robotics and Automation Letters* (chosen for presentation at the 2018 IEEE International Conference on Robotics and Automation), vol. 3, no. 3, pp. 1671-1678, 2018

[J5] **J. Zhang**, A. Simeonov and M. C. Yip, "Three-dimensional hysteresis compensation enhances accuracy of robotic artificial muscles," *Smart Materials and Structures*, vol. 27, no. 3, p. 035002, 2018

[J6] **J. Zhang**, K. Iyer, A. Simeonov and M. C. Yip, "Modeling and inverse compensation of hysteresis in super-coiled polymer actuators," *IEEE Robotics and Automation Letters* (chosen for presentation at the 2017 IEEE International Conference on Robotics and Automation), vol. 2, no. 2, pp. 773-780, 2017.

[J7] D. Torres, **J. Zhang**, S. Dooley, X. Tan, N. Sepúlveda, "Modeling of MEMS mirrors actuated by phase-change mechanism," (**Invited paper** for special issue on MEMS Mirrors), *Micromachines*, vol. 8, no. 5: 138, pp. 1-17, 2017

[J8] **J. Zhang**, D. Torres, J. L. Ebel, N. Sepúlveda and X. Tan, "A composite hysteresis model in self-sensing feedback control of fully integrated VO_2 microactuators," *IEEE/ASME Transactions on Mechatronics*, vol. 21, no. 5, pp. 2405-2417, 2016

[J9] **J. Zhang**, D. Torres, N. Sepúlveda and X. Tan, "A compressive sensing-based approach for Preisach hysteresis model identification," *Smart Materials and Structures*, vol. 25, no. 7, p. 075008, 2016

[J10] D. Torres, T. Wang, **J. Zhang**, X. Zhang, S. Dooley, J. Ebel, X. Tan, H. Xie, N. Sepúlveda, "VO_2-based MEMS mirrors," *Journal of Microelectromechanical Systems*, vol. 25, no. 4, pp. 780-787, 2016

[J11] **J. Zhang**, E. Merced, N. Sepúlveda and X. Tan, "Optimal compression of generalized Prandtl-Ishlinskii hysteresis models," *Automatica*, vol. 57, pp. 170-179, 2015

[J12] **J. Zhang**, E. Merced, N. Sepúlveda and X. Tan, "Modeling and inverse compensation of hysteresis in vanadium dioxide using an extended generalized Prandtl-Ishlinskii model," *Smart materials and Structures*, vol. 23, no. 12, p. 125017, 2014

[J13] **J. Zhang**, E. Merced, N. Sepúlveda and X. Tan, "Modeling and inverse compensation of non-monotonic hysteresis in VO_2-coated microactuators," *IEEE/ASME Transactions on Mechatronics*, vol. 19, no. 2, pp. 579-588, 2014

[J14] E. Merced, **J. Zhang**, X. Tan and N. Sepúlveda, "Robust control of VO_2-coated micro-benders using self-sensing feedback," *IEEE/ASME Transactions on Mechatronics*, vol. 19, no. 5, pp. 1583-1592, 2014

CONFERENCE PROCEEDINGS

[C1] D. Bombara, V. Mansurov, R. Konda, S. Fowzer and **J. Zhang**, "Self-sensing for twisted string actuators using conductive supercoiled polymers," *Proceedings of ASME 2019 Conference on Smart Materials, Adaptive Structures and Intelligent Systems*, Louisville, KY, under review

[C2] R. Konda and **J. Zhang**, "The effects of nylon polymer threads on hysteresis behavior of supercoiled polymer (SCP) artificial muscles," [**Invited**], *Proceedings of the 2019 ASME Dynamic Systems and Control Conference*, Park City, UT, USA, under review

[C3] **J. Zhang**, D. Torres, N. Sepúlveda and X. Tan, "Programming of systems with hysteresis using pulsed inputs," *Proceedings of the 2018 American Control Conference*, Milwaukee, WI, USA, pp. 4490-4495, 2018

[C4] **J. Zhang** and M. C. Yip, "Three-dimensional hysteresis modeling of robotic artificial muscles

with application to shape memory alloy actuators," *Proceedings of the 2017 Robotics: Science and Systems XIII*, Cambridge, Massachusetts, USA, 2017

[C5] D. Torres, T. Wang, **J. Zhang**, S. Dooley, X. Tan, N. Sepúlveda, "Experimental characterization of the dynamics of VO_2-based MEMS mirrors," *Proceedings of ASME 2016 Conference on Smart Materials, Adaptive Structures and Intelligent Systems*, Stowe, Vermont, USA, Paper SMASIS2016-9129 (7 pp), 2016

[C6] A. Abul, **J. Zhang**, R. Steidl, R. Gemma and X. Tan, "Microbial fuel cells: Control-oriented modeling and experimental validation," *Proceedings of the 2016 American Control Conference*, Boston, MA, USA, pp. 412-417, 2016

[C7] **J. Zhang**, D. Torres, N. Sepúlveda and X. Tan, "Compressive sensing-based Preisach hysteresis model identification" [**Invited**], *Proceedings of the 2015 American Control Conference*, Chicago, IL, USA, pp. 2637-2642, 2015

[C8] **J. Zhang**, D. Torres, E. Merced, N. Sepúlveda and X. Tan, "A hysteresis-compensated self-sensing scheme for vanadium dioxide-coated microactuators," *Proceedings of the 2014 ASME Dynamic Systems and Control Conference*, San Antonio, TX, USA, Paper DSCC2014-6222 (10 pp), 2014

[C9] **J. Zhang**, E. Merced, N. Sepúlveda and X. Tan, "Inversion of an extended generalized Prandtl-Ishlinskii hysteresis model: Theory and experimental results" [**Invited**], *Proceedings of the the 2014 American Control Conference*, Portland, OR, USA, pp. 4765-4770, 2014

[C10] **J. Zhang**, E. Merced, N. Sepúlveda and X. Tan, "Optimal compression of a generalized Prandtl-Ishlinskii operator in hysteresis modeling," *Proceedings of the 2013 ASME Dynamic Systems and Control Conference*, Palo Alto, CA, USA, Paper DSCC2013-3969 (10 pp), 2013 [**Best Conference Paper in Applications Award**]

[C11] E. Merced, **J. Zhang**, X. Tan and N. Sepúlveda, "Robust control of VO_2-coated microactuators based on self-sensing feedback," *Proceedings of 2013 IEEE/ASME International Conference on Advanced Intelligent Mechatronics*, Wollongong, Ausrilia, pp. 656-661, 2013 [**Finalist for Best Conference Paper Award**]

[C12] **J. Zhang**, E. Merced, N. Sepúlveda and X. Tan, "Kullback-Leibler divergence-based optimal compression of Preisach operator in hysteresis modeling", *Proceedings of the the 2013 American Control Conference*, Washington, DC, USA, pp. 89-94, 2013

[C13] **J. Zhang**, E. Merced, N. Sepúlveda and X. Tan, "Modeling of non-monotonic hysteresis behavior in VO_2-coated microactuators," *Proceedings of ASME 2012 Conference on Smart Materials, Adaptive Structures and Intelligent Systems*, Stone Mountain, GA, USA, Paper SMASIS2012-7940 (10 pp), 2012 [**Student Best Paper Competition Award**]

[C14] E. Merced, **J. Zhang**, X. Tan and N. Sepúlveda, "Experimental characterization of work per volumn density of VO_2-based MEMS actuators," *Proceedings of ASME 2012 Conference on Smart Materials, Adaptive Structures and Intelligent Systems*, Stone Mountain, GA, USA, Paper SMASIS2012-7975 (7 pp), 2012

WORKSHOP PAPERS

[W1] **J. Zhang** and M. C. Yip, "Three-dimensional hysteresis modeling of robotic artificial muscles with application to shape memory alloy actuators," *Robotics: Science and Systems*, in workshop: *Material Robotics – Bridging Materials Science and Robotics*, (3 pp), Cambridge, Massachusetts,

USA, 2017

[W2] **J. Zhang** and M. C. Yip, "Designing muscle-powered robotics with super-coiled polymers," *Robotics: Science and Systems*, in workshop: *Robot Makers: The future of digital rapid design and fabrication of robots*, (4 pp), Ann Arbor, MI, USA, 2016

PATENTS

[P1] M. C. Yip, **J. Zhang**, A. Tran and W. Kuang, "System and method for robust and low-cost multi-axis force sensor," U.S. Provisional Patent Application 62/433578, 2016

SEMINARS AND TALKS

[1] "Smart materials for motion generation: Analysis and robotic applications", Neuro Journal Club, University of Nevada Reno, Reno, NV, November 1, 2018, (Host: Dr. Dennis Mathew)

[2] "Motion generation with smart materials: Scalable solutions to modeling, control, and design", ME 100/200 Seminar Series, Department of Mechanical Engineering, University of California Santa Barbara, Santa Barbara, CA, April 9, 2018, (Host: Dr. Francesco Bullo)

[3] "Motion generation with smart materials: Scalable solutions to modeling, control, and design", Department of Mechanical Engineering, Temple University, Philadelphia, PA, April 3, 2018, (Host: Dr. Haijun Liu)

[4] "Motion generation with smart materials: Scalable solutions to modeling, control, and design", Department of Mechanical Engineering, University of Massachusetts Lowell, Lowell, MA, March 30, 2018, (Host: Dr. Gu Yan)

[5] "Motion generation with smart materials: Scalable solutions to modeling, control, and design", Department of Mechanical Engineering, University of Akron, Akron, OH, February 26, 2018, (Host: Dr. Kwek-Tze Tan)

[6] "Motion generation with smart materials: Scalable solutions to modeling, control, and design", Department of Mechanical Engineering, University of Nevada Reno, Reno, NV, January 23, 2018, (Host: Dr. Eric Wang)

[7] "Motion generation with smart materials: Scalable solutions to modeling, control, and design", Department of Mechanical Engineering, University of Arkansas, Fayetteville, AR, January 18, 2018, (Host: Dr. Darin Nutter)

[8] "Motion generation with smart materials: Scalable solutions to modeling, control, and design", Department of Mechanical and Aerospace Engineering, Utah State University, Logan, UT, November 6, 2017, (Host: Dr. Geordie Richards)

[9] "Modeling, control, and design of smart actuators with applications to intelligent systems", ECE Seminar Series, Department of Electrical and Computer Engineering, Michigan State University, East Lansing, MI, September 29, 2017, (Host: Dr. Xiaobo Tan)

ADVISING
Graduate Students Advisees
- Revanth Konda (PhD student), Mechanical Engineering, 2019/01 - present
- Thulani Tsabedze (PhD student), Mechanical Engineering, 2019/01 - present

- Vasilii Mansurov (Master student), Electrical Engineering (Biomedical Emphasis), 2019/02 - present

Undergraduates Students Advisees
- Christopher Mullen, Mechanical Engineering, 2019/05 - present
- Christopher Fulwider, Mechanical Engineering, 2019/05 - present
- Ryan Coulter, Mechanical Engineering [**NSF REU participant, 2019 Summer**], 2019/04 - present
- Steven Fowzer, Mechanical Engineering, 2019/03 - present
- Lyndie Munson, Mechanical Engineering, 2019/03 - present
- David Bombara, Mechanical Engineering [**Nevada Undergraduate Research Award, 2019 Spring**], 2018/10 - present
- Aaron Wiese, Mechanical Engineering [**Nevada Undergraduate Research Award, 2019 Spring**], 2018/09 - 2019/05
- Capstone Team (Robot Assistive Glove): Christopher Mullen, Silvio Reggiardo, Anthony Johnson, Clayton Frieders, Aaron Wiese, Mechanical Engineering, 2018/09 - 2019/05

Undergraduates Students
- Scott Wade, Davidson Academy of Nevada, 2019/05 - present

Mentoring Before Joining UNR:
- Yijing Li (Master student), Electrical and Computer Engineering, 2018/01 - 2018/04
- Tianyu Wang (PhD student), Electrical and Computer Engineering, 2017/01 - 2018/01 (UCSD ECE PRIME Hierarchical Mentoring Program)
- Winnie Kuang (Undergrad), Mechanical Engineering, 2016/04 - 2018/08
- Adam Factor (Undergrad), Bioengineering, 2017/04 - 2018/05
- Guhan Sundar (Undergrad), Bioengineering, 2016/09 - 2018/05
- Zixuan Lan (Undergrad), Mechanical Engineering, 2016/09 - 2018/03
- Taylor West (Undergrad), Bioengineering, 2016/05 - 2018/02
- Anthony Simeonov (Undergrad), Mechanical Engineering, 2016/03 - 2017/09
- Alex Tran (Undergrad), Bioengineering, 2016/04 - 2016/09
- Kaushik Iyer (Undergrad), Bioengineering, 2016/02 - 2016/06

Member of Completed Dissertation
- Amir Mohammadi Nasab (Advisor: Wanliang Shan/ME), Ph.D., 2019

TEACHING

1. ME 410, *Introduction to System Control* (Fall 2018, Fall 2019)
2. ME 422/622, *Introduction to Robotics* (Spring 2019)

PROFESSIONAL MEMBERSHIP AND SERVICE

Society Membership

1. Member, American Society of Mechanical Engineers (ASME)   2016 - present
2. Member, Institute of Electrical and Electronics Engineers (IEEE)   2016 - present
3. Member, IEEE Robotics and Automation Society (RAS)   2017 - present

Editorial Services

1. Associate Editor and Conference Editorial Board member, 2019 IEEE International Conference on Soft Robotics (RoboSoft 2019)
2. Program committee member, 2018 IEEE International Conference on Robotics and Biomimetics (ROBIO 2018)

Reviewer for Funding Agencies

- NASA Nevada Space Grant, 2019
- Panelist, NSF, 2018; 2019
- Ad hoc reviewer, NSF, 2017

Reviewer for Archival Journals

1. Advanced Engineering Materials
2. Advanced Robotics
3. Asian Journal of Control
4. ASME Journal of Dynamic Systems, Measurement and Control
5. IEEE Robotics and Automation Letters
6. IEEE Transactions on Automatic Control
7. IEEE Transactions on Control Systems Technology
8. IEEE/ASME Transactions on Mechatronics
9. IEEE Transactions on Industrial Electronics
10. IEEE Transactions on Robotics
11. International Journal of Intelligent Robotics and Applications
12. Journal of Intelligent Material Systems and Structures
13. Mechanical Systems and Signal Processing
14. Mechatronics
15. Robotics and Biomimetics
16. Robotics and Computer Integrated Manufacturing
17. Smart Materials and Structures

Reviewer for Conferences

1. American Control Conference (ACC 2014, 2016, 2017, 2019)

2. ASME Conference on Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS 2019)

3. ASME Dynamic Systems and Control Conference (DSCC 2012, 2013, 2018, 2019)

4. IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM 2018, 2019)

5. IEEE Conference on Decision and Control (CDC 2016)

6. IEEE International Conference on Robotics and Automation (ICRA 2018)

7. IEEE International Conference on Robotics and Biomimetics (ROBIO 2018)

8. IEEE International Conference on Soft Robotics (RoboSoft 2018)

9. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2018)

10. IFAC World Congress (WC 2017)

INSTITUTIONAL SERVICE

University Committees

1. Judge, UNR Graduate Poster Symposium   November 2018
2. Evaluator, UNR Graduate Research Grant Program   October 2018

Department Committees

1. Member, Faculty Search Committee (Aerospace System)   September 2018 - present