Ming Luo

Mechanically-Intelligent Autonomous Robotics Laboratory (MIAR Lab)
School of Mechanical and Materials Engineering, Washington State University
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Expertise

Soft Robots; Snake Robots; Origami Foldable Robots; Haptics; Robot Control

Education

Worcester Polytechnic Institute, Worcester, MA
Ph.D in Robotics Engineering 2017, Advisor: Dr. Cagdas D. Onal
Southeastern Louisiana University, Hammond, LA
M.S. in Computer Science & Industrial Technology 2012, Advisor: Dr. S. Raj Pandian
Tian Jin Polytechnic University, China
B.S. in Electronic and Information Engineering 2010

Work Experience

2020.08 ~ present, Assistant Professor, Mechanical and Materials Engineering, Washington State University, Pullman, WA
2018.03 ~ 2020.08**,** Postdoctoral Scholar, Stanford University**,** Collaborative Haptics in Robotics and Medicine (CHARM) Lab, Advisor: Dr. Allison M. Okamura
2017.09 ~ 2018.03, CTO, Powerhive, Worcester, MA

Journal Publications

1. **M. Luo**, Z. Wan, Y. Sun, E. H. Skorina, W. Tao, F. Chen, L. Gopalka, H. Yang, and C. D. Onal. "Motion Planning and Iterative Learning Control of a Modular Soft Robotic Snake." Frontiers in Robotics and AI 7 (2020): 191.
2. S. Kanjanapas, C.M. Nunez, S.R. Williams, A.M. Okamura, and **M. Luo (Corresponding author). "**Design and Analysis of Pneumatic 2-DoF Soft Haptic Devices for Shear Display", IEEE Robotics and Automation Letters. (2019).
3. **M. Luo**, R. Yan (Co-first author), Z. Wan, Y. Qin, J. Santoso, E. H. Skorina, C. D. Onal. "OriSnake: Design, Fabrication and Experimental Analysis of a 3-D Origami Snake Robot", IEEE Robotics and Automation Letters, (2018).
4. E. H. Skorina, **M. Luo** and C. D. Onal. "Soft Robotic Haptic Wrist Feedback". Frontiers in Robotics and AI, section Soft Robotics, (2018).
5. **M. Luo**, E. H. Skorina, W. Tao, F. Chen, S. Ozel, Y. Sun and C. D. Onal. "Toward Modular Soft Robotics: Proprioceptive Curvature Sensing and Sliding-Mode Control of Soft Bidirectional Bending Modules". Soft Robotics, (2017).

6. E.H. Skorina, **M. Luo**, W. Tao, F. Chen, J. Fu, C.D. Onal. "Adapting to Flexibility: Model Reference Adaptive Control of Soft Bending Actuators", IEEE Robotics and Automation Letters, (2017).
7. **M. Luo**, Y. Pan, E.H. Skorina, W. Tao, F. Chen, S. Ozel, C.D. Onal. "Slithering towards autonomy: a self-contained soft robotic snake platform with integrated curvature sensing", Bioinspiration & Biomimetics 10:055001, (2015) **(Cover article for the Special issue on Bioinspired Soft Robotics, Among Bioinspiration & Biomimetics Highlights of 2015)** .
8. **M. Luo**, M. Agheli, C.D. Onal. "Theoretical Modeling and Experimental Analysis of a Pressure-Operated Soft Robotic Snake", Soft Robotics, 1(2):136-146 (2014).

Conference Publications

1. K. Yoshida, X. Ren, L. H. Blumenschein, A. M. Okamura, and **M. Luo (Corresponding author)**. "AFREEs: "Active Fiber Reinforced Elastomeric Enclosures", IEEE International Conference on Soft Robotics (RoboSoft) 2020 (**Nominated for the Best Paper Award**).
2. F. Stroppa, **M. Luo**, K. Yoshida, M. M. Coad, L. H. Blumenschein, and A. M. Okamura. "Human Interface for Teleoperated Object Manipulation with a Soft Growing Robot", IEEE International Conference on Robotics and Automation (ICRA) 2020 (**Nominated for the Best Paper Award in Human-Robot Interaction (HRI)**)
3. K. Yoshida, C.M. Nunez, S.R. Williams, A.M. Okamura, and **M. Luo (Corresponding author)**. "3-DoF Wearable, Pneumatic Haptic Device to Deliver Normal, Shear, Vibration, and Torsion Feedback", IEEE World Haptics Conference.
4. Y. Qin, Z. Wan, Y. Sun, EH. Skorina, **M. Luo**, C.D. Onal." Design, Fabrication and Experimental Analysis of a 3-D Soft Robotic Snake", IEEE International Conference on Soft Robotics (RoboSoft) 2018.
5. J. Santoso, E.H. Skorina, **M. Luo**, R. Yan, C.D. Onal, "Design and Analysis of an Origami Continuum Manipulation Module with Torsional Strength", IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), (2017).
6. S. Ozel, E.H. Skorina, **M. Luo**, W. Tao, F. Chen, Y. Pan, C.D. Onal. "A Composite Soft Bending Actuation Module with Integrated Curvature Sensing", IEEE International Conference on Robotics and Automation (ICRA) pp. 4963-4968, (2016).
7. E.H. Skorina, W. Tao, F. Chen, **M. Luo**, C.D. Onal. "Motion Control of a Soft-Actuated Modular Manipulator", IEEE International Conference on Robotics and Automation (ICRA) pp. 4997-5002, (2016).
8. Y. Pan, **M. Luo**, E.H. Skorina, C.D. Onal, "Controlling the Bending Response of a Multi-Layer Composite Module", Proc. Adhesion Society Annual Meeting, (2016).
9. **M. Luo**, Y. Pan, W. Tao, F. Chen, E.H. Skorina, C.D. Onal. "Refined Theoretical Modeling of a New-generation Pressure-operated Soft Snake", Proceedings of the ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE), (2015).
10. **M. Luo**, E.H. Skorina, W. Tao, F. Chen, C.D. Onal. "Optimized Design of a Rigid Kinematic Module for Antagonistic Soft Actuation", IEEE International Conference on Technologies for Practical Robot Applications (TePRA), (2015).

11. E.H. Skorina, **M. Luo**, S. Ozel, F. Chen, W. Tao, C.D. Onal. "Feedforward augmented Sliding Mode Motion Control of Antagonistic Soft Pneumatic Actuators", IEEE International Conference on Robotics and Automation (ICRA), (2015).
12. W. Tao, E.H. Skorina, F. Chen, J. McInnis, **M. Luo** C.D. Onal. "Bioinspired Design and Fabrication Principles of Reliable Fluidic Soft Actuation Modules", IEEE International Conference on Robotics and Biomimetics (ROBIO), 2169-2174, (2015).
13. **M. Luo**, W. Tao, F. Chen, T.K. Khuu, S. Ozel, C.D. Onal. "Design Improvements and Dynamic Characterization on Fluidic Elastomer Actuators for a Soft Robotic Snake", IEEE International Conference on Technologies for Practical Robot Applications (TePRA), (2014).
14. **M. Luo**, M. Agheli, C.D. Onal. "Theoretical Modeling of a Pressure-Operated Soft Snake Robot", Proceedings of the ASME 2014 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE), (2014).

Book Chapters

1. K. N. Kaipa, C. D. Onal, V. Jovanovic, A. Djuric, **M. Luo**, M. P. Nowers, and M. B. Popovic. " Bionspired Robotics", Biomechatronics, Elsevier (2019). Pages: 495:542.

Workshops

1. **M. Luo**, E H. Skorina, W. Tao, F. Chen, C.D. Onal. "Slithering Towards Autonomy: Evolution of the WPI Soft Robotic Snake." In Proceedings of the IROS Workshop on New Frontiers and Applications for Soft Robots, 2015.
2. **M. Luo**, and S. Pandian, Vision-based navigation of an indoor mobile robot using road information segmentation. The Louisiana Academy of Sciences conference, February 26, 2011, University of Louisiana at Monroe.

Funded Proposals

2020.08: Stanford RISE COVID-19 Crisis Response Trainee Seed Grant Program. Title: A Pneumatic N95 Mask Augmentation to Improve Healthcare Worker Safety (PI: Ming Luo)

Patents

1. P. Saraj, A. Caracappa, P. Luxsuwong, C.D. Onal, W. Michalson, T. Khuu, and **M. Luo**. "Haptic glove as a wearable force feedback user interface." U.S. Patent 20170322629A1, issued May 4, 2017.

Teaching Experiences

2017. 09 Guest Lecture, "Soft Pneumatic Robots", RBE 595 191M: Smart Materials and Actuation, Robotics Engineering, Worcester Polytechnic Institute.

Invited Presentations

2020.11.09 NUWC Seminar: Soft Growing Robots and Soft wearable haptic device.
2020.08.27 Washington State University School of Mechanical and Materials Science Seminar: Soft Pneumatic robots: Designing for more dexterity.

2018.05.18 Stanford Robotics Seminar: Design, Theoretical Modeling, Motion Planning, and Control of a Pressure-operated Modular Soft Robotic Snake.

Reviews

Soft Robotics (SORO); Bioinspiration and Biomimetics; IEEE Robotics and Automation Letters (RA-L); IEEE Transactions on Control Systems Technology; IEEE Transactions on Haptics (ToH); Energies; Sensors; Applied sciences; Sensors & Actuators: A. Physical; Actuators; Journal of Medical Robotics Research (JMRR); Part C: Journal of Mechanical Engineering Science; IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS); IEEE International Conference on Robotics and Automation (ICRA); IEEE International Conference on Advanced Intelligent Mechatronics (AIM); IEEE International Conference on Technologies for Practical Robot Applications (Tepra); IEEE International Conference on Soft Robotics (RoboSoft); The ACM Symposium on Virtual Reality Software and Technology (VRST); IEEE World Haptics Conference (WHC)

Media Cover

- Enhanced face mask project was featured in "COVID-19 prompts Stanford engineers to rethink the humble face mask" from Stanford news (2020).
- Orisnake is featured in "Robotic Snake Could Speed Search-and-Rescue Missions" from IEEE Xplore (2019).
- Soft snake robot is featured in "Snake on a plane! Don't panic, it's probably just a (soft) robot" from REUTRES (2017).
- Soft snake robot is featured in "The robots of the future won't look anything like the Terminator" from The Verge (2014).

Awards

- First place in IEEE International Conference on Robotics and Automation (ICRA) 2017 soft robot speed challenge (Team leader).
- WPI Graduate student travel fund (2017).
- IEEE International Conference on Robotics and Automation (ICRA) 2017 travel fund.

Interests

Table tennis

- 2011 USA AAU Junior Olympics Boys U22 Singles -Gold Medalist, Boys U22 Team- Gold Medalist & Doubles - Gold Medalist.
- Leads a team to win Division 8A championship of 2011 NA Teams of Baltimore.
- 2011 New Orleans Open single-Gold Medalist.
- The People's Republic of China Second Sportsman Technical Grade Certificate.
- The People's Republic of China Second Referee Technical Grade Certificate.