

Andrew P. Sabelhaus

5827 Holden St. #3, Pittsburgh PA 15232

www.apsabelhaus.com | apsabelhaus@cmu.edu | (301) 807-9842 | he, him, his

EDUCATION

PH.D. MECHANICAL ENGINEERING

Dissertation title: *Quadruped Robots with Tensegrity Spines*

Dissertation Committee: Alice M. Agogino (Chair), Andrew Packard, Claire Tomlin, Murat Arcak

University of California, Berkeley

August 2019

M.S. MECHANICAL ENGINEERING

Thesis: *Mechanism and Sensor Design for SUPERball, a Cable-Driven Tensegrity Robot*

University of California, Berkeley

Dec. 2014

B.S. MECHANICAL ENGINEERING MINOR: COMPUTER SCIENCE

University of Maryland, College Park

May 2012

PROFESSIONAL EXPERIENCE

Carnegie Mellon University

Dept. of Mechanical Engineering
Soft Machines Lab (PI: Carmel Majidi)

Postdoctoral Research Associate

2019 - Present
Pittsburgh, PA

NASA Ames Research Center

Intelligent Systems Division
Intelligent Robotics Group and Robust Software Engineering

Visiting Technologist

2015 - 2019
Moffet Field, CA

University of California, Berkeley

Dept. of Mechanical Engineering
Berkeley Emergent Space Tensegrities Lab (PI: Alice Agogino)

Graduate Student Researcher

2012-2019
Berkeley, CA

GRANTS + FUNDING

4. **NASA Space Technology Research Fellowship.** 4 years. Title: *Trajectory Tracking in Nonlinear, High-Order, Underactuated Robotic Systems.* 2015-2019.
3. **CITRIS Tech for Social Good Development Grant.** Block grant. Title: *Laika, The Robot Transport for Disaster Relief.* University of California Center for Information Technology Research in the Interest of Society (CITRIS), 2018.
2. **Markowski-Leach Scholarship Award.** 4 years (re-awarded after two.) Awarded to LGBTQ individuals at San Francisco Bay Area institutions who "are likely to make a substantial contribution to society." 2013-2014, 2016-2018. Currently the only repeated awardee on record.
1. **NSF Graduate Research Fellowship.** National Science Foundation. 2012-2015

PEER-REVIEWED PUBLICATIONS

12. **A.P. Sabelhaus**, A.H. Li, K.A. Sover, J. Madden, A. Barkan, A.K. Agogino, A.M. Agogino, "Inverse Statics Optimization for Compound Tensegrity Robots." *IEEE Robotics and Automation Letters*, 2020. doi:10.1109/LRA.2020.2983699
11. **A.P. Sabelhaus**, H. Zhao, E. Zhu, A.K. Agogino, A.M. Agogino, "Model-Predictive Control with Inverse Statics Optimization for Tensegrity Spine Robots." *IEEE Transactions on Control System Technology*, 2020. doi:10.1109/TCST.2020.2975138
10. L.H. Chen, M.C. Daly, **A.P. Sabelhaus**, L.A. Janse van Vuuren, H.J. Garnier, M.I. Verdugo, E. Tang, C.U. Spangenberg, F. Ghahani, A.K. Agogino, A.M. Agogino, "Modular Elastic Lattice Platform for Rapid Prototyping of Tensegrity Robots." *ASME International Design Engineering Technical Conferences (IDETC) / 41st Mechanisms and Robotics Conference*, Aug 2017. doi:10.1115/DETC2017-68264

9. **A.P. Sabelhaus**, A.K. Akella, Z.A. Ahmad, V. SunSpiral, "Model-Predictive Control of a Flexible Spine Robot." *American Control Conference (ACC)*, IEEE, May 2017. doi:10.23919/ACC.2017.7963738
8. K. Zampaglione, **A.P. Sabelhaus**, L.H. Chen, A.M. Agogino, A.K. Agogino, "DNA-Structured Linear Actuators." *ASME International Design Engineering Technical Conferences (IDETC) / 40th Mechanisms and Robotics Conference*, Aug 2016. doi:10.1115/DETC2016-60291
7. **A.P. Sabelhaus**, H. Ji, P. Hylton, Y. Madaan, C. Yang, J. Friesen, V. SunSpiral, A.M. Agogino, "Mechanism Design and Simulation of the ULTRA Spine, a Tensegrity Robot." *ASME International Design Engineering Technical Conferences (IDETC) / 39th Mechanisms and Robotics Conference*, Aug 2015. doi:10.1115/DETC2015-47583
6. **A.P. Sabelhaus**, J. Bruce, K. Caluwaerts, P. Manovi, R.F. Firoozi, S. Dobi, A.M. Agogino, V. SunSpiral, "System Design and Locomotion of SUPERball, an Untethered Tensegrity Robot." *IEEE International Conference on Robotics and Automation (ICRA)*, May 2015. doi:10.1109/ICRA.2015.7139590
5. K. Caluwaerts, J. Despraz, A. Iscen, **A.P. Sabelhaus**, J. Bruce, B. Schrauwen, V. SunSpiral, "Design and Control of Compliant Tensegrity Robots through Simulation and Hardware Validation." *Journal of the Royal Society Interface*, 2014. doi:10.1098/rsif.2014.0520
4. **A.P. Sabelhaus**, J. Bruce, K. Caluwaerts, Y. Chen, D. Lu, Y. Liu, A.K. Agogino, V. SunSpiral, A.M. Agogino, "Hardware Design and Testing of SUPERball, a Modular Tensegrity Robot." *The 6th World Conference on Structural Control and Monitoring (6WCSCM)*, July 2014.
3. J. Bruce, **A.P. Sabelhaus**, Y. Chen, D. Lu, K. Morse, S. Milam, K. Caluwaerts, A.M. Agogino, V. SunSpiral, "SUPERball: Exploring Tensegrities for Planetary Probes." *12th International Symposium on Artificial Intelligence, Robotics, and Automation in Space (i-SAIRAS)*, June 2014.
2. J. Bruce, K. Caluwaerts, A. Iscen, **A.P. Sabelhaus**, V. SunSpiral, "Design and Evolution of a Modular Tensegrity Robot Platform." *IEEE International Conference on Robotics and Automation (ICRA)*, May 2014. doi:10.1109/ICRA.2014.6907361
1. **A.P. Sabelhaus**, D. Mirsky, L.M. Hill, S. Bergbreiter, "TinyTeRP: A Tiny Terrestrial Robotic Platform with Modular Sensing." *IEEE International Conference on Robotics and Automation (ICRA)*, May 2013. doi: 10.1109/ICRA.2013.6630933

PRE-PRINTS + PUBLICATIONS UNDER REVIEW

2. Z. Patterson, **A.P. Sabelhaus**, K. Chin, C. Majidi, "An Untethered Brittle Star Robot for Closed-Loop Underwater Locomotion." *Under Review, IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2020. Preprint available upon request.
1. **A.P. Sabelhaus**, L.A. Janse van Vuuren, A. Joshi, E. Zhu, H.J. Garnier, K.A. Sover, J. Navarro, A.K. Agogino, V. SunSpiral, A.M. Agogino, "Design, Simulation, and Testing of a Flexible Actuated Spine for Quadruped Robots." *Preprint Only. Available, arXiv:1804.06527*

IN-PREPARATION PUBLICATIONS

1. **A.P. Sabelhaus**, E. Tang, K. Zampaglione, L.H. Chen, A.M. Agogino, "Twisted Helix Linear Actuators."

PATENTS

2. A. Agogino, K. Zampaglione, L.-H. Chen, **A.P. Sabelhaus**, "DNA Structured Linear Actuator." *US Patent No. 10,630,208*, issued April 21, 2020.
1. L.-H. Chen, A. Agogino, M. Daly, **A.P. Sabelhaus**, A.K. Agogino, "Elastic Lattices for Design of Tensegrity Structures and Robots." *Under review, US Patent Application No. US20190382995A1*.

PRESENTATIONS + POSTERS

*Asterisk indicates an invited talk or invited presentation.

9. * **Laika and Belka: Walking Robots with Flexible Spines**. Workshop on Autonomy for Future NASA Science Missions, Oct. 2018. Presentation and poster, by invitation.

8. * **Laika, The Four-Legged Robot with a Flexible Spine.** NASA Space Tehnology Day-On-The-Hill, Nov. 2017. Poster, by invitation, presented to the United States Congress / U.S. House of Representatives.
7. **Laika, The Quadruped Robot with a Tensegrity Spine.** Bay Area Robotics Symposium (BARS), Oct. 2017. Presentation and Poster.
6. **UC Berkeley Robotics for Disaster Relief.** Field Innovation Team Bootcamp 5.0, March 2017. Presentation.
5. **DNA-Structured Linear Actuators.** SKTA Innopartners IP Redux Event, Apr 2016. Presentation.
4. **ULTRA Spine Project.** Bay Area Robotics Symposium (BARS), Oct 2015. Presentation and Poster.
3. * **Robotics, Mechatronics, and Intelligent Systems.** Osher Lifelong Learning Institute, Feb 2014. Invited Talk.
2. **Mechatronic Design of Tensegrity Robotic Systems for Dynamic Locomotion.** NASA Ames Research Center Autonomous Systems Lab Poster Symposium, Aug 2013. Poster.
1. **TinyTeRP: A Tiny Terrestrial Robotic Platform.** International Symposium on Distributed Autonomous Robotic Systems (DARS), Nov 2012. Poster.

REVIEWER FOR JOURNALS AND CONFERENCES

Drew has served as a reviewer for the following journals and conferences:

- IEEE Transactions on Control System Technology (T-CST), 2018
- Journal of Open-Source Software (JOSS), 2018-2019
- IEEE Robotics and Automation Magazine (RA-M), 2018
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2018
- IEEE Robotics and Automation Letters (RA-L), 2017-2019
- IEEE International Conference on Robotics and Automation (ICRA), 2017, 2019
- American Control Conference (ACC), 2017-2018.
- ASME International Design Engineering Technical Conference (IDETC), 2016-2017.
- International Journal of Space Structures, 2017.
- IEEE Conference on Control Technology and Applications (CCTA), 2017.

TEACHING

2. **Outstanding Graduate Student Instructor (GSI) Award.** University of California, Berkeley, 2019
1. **Graduate Student Instructor (GSI).** University of California, Berkeley
Jan. - May, 2018 | Mech. Eng. 135/235, Design of Microprocessor-Based Mechanical Systems
 - Created course content for lab and discussion sections, delivered stand-in lectures, assisted students with projects.
 - Overall Course Evaluations: *Total Effectiveness of Instructor: 4.7/5.0 (Undergrad.), 4.88/5.0 (Grad.)*
 - Teaching evaluations were above department averages in every metric.

DIVERSITY + OUTREACH + SERVICE

- **ASME Diversity and Inclusion Strategic Committee (DISC), Advisor.** American Society of Mechanical Engineers (ASME). Revised ASME policy P-15.11, PS16-02, and Statement on Diversity and Inclusion to include protections for transgender ASME members. June 2016 - 2018.
- **ASME LGBTQ Virtual Community of Practice, Member.** American Society for Engineering Education. Organizing for LGBTQ safe space workshops in engineering. March 2018 - Ongoing.
- **Graduate Student Search Committee, Member.** UC Berkeley Mechanical Engineering Faculty Searches. Led committee in interviewing and recommending faculty candidates. Spring 2017 - Spring 2018.
- **Graduate Peer Advisor.** UC Berkeley Mechanical Engineering - Equity, Diversity, and Inclusion Initiative. Created and assessed various programs serving under-represented students. Aug 2014 - May 2015.
- **Coordinator, Chapter Leadership Programs.** Out in Science, Technology, Engineering, and Mathematics (oSTEM) Incorporated. Led team in developing resources for LGBTQ student leaders. July 2012 - April 2013.
*In addition to these formal programs, Drew has organized many lab tours and smaller outreach events, and has volunteered with programs that recruit under-represented students to UC Berkeley.

PROFESSIONAL DEVELOPMENT

- **Summer Institute for Preparing Future Faculty.** A professional development program to prepare students for academic careers. University of California, Berkeley. Completed / certified in June 2018.
- **Question, Persuade, Refer: Gatekeeper.** Trained for response to mental health crises in students. University of California Berkeley Health Center, March 2018.
- **Teaching of Mechanical Engineering at the University Level.** UC Berkeley Mechanical Engineering Department. Course on teaching pedagogy in engineering. Spring 2018.
- **Workshops on Teaching and Learning.** UC Berkeley GSI Teaching and Resource Center / Academic Innovation Studio. Attended workshops on teaching pedagogy, including 'How Students Learn' and 'Teaming With Diversity.' Fall 2017 - Spring 2018.
- **Teaching Conference for Graduate Student Instructors.** UC Berkeley GSI Teaching and Resource Center. Introductory pedagogy for first-time Graduate Student Instructors. Attended in Jan. 2018.