Andrew P. Sabelhaus

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EDUCATION

PH.D. MECHANICAL ENGINEERING — University of California, Berkeley
Dissertation title: *Quadruped Robots with Tensegrity Spines* — August 2019
Dissertation Committee: *Alice M. Agogino (Chair), Andrew Packard, Claire Tomlin, Murat Arcak*

M.S. MECHANICAL ENGINEERING — University of California, Berkeley
Thesis: *Mechanism and Sensor Design for SUPERball, a Cable-Driven Tensegrity Robot* — Dec. 2014

B.S. MECHANICAL ENGINEERING — University of Maryland, College Park
Minor in Computer Science — May 2012

PROFESSIONAL EXPERIENCE

Carnegie Mellon University — Postdoctoral Research Associate
Dept. of Mechanical Engineering — 2019 - Present
Soft Machines Lab (*PI: Carmel Majidi*) — Pittsburgh, PA

NASA Ames Research Center — Visiting Technologist
Intelligent Systems Division — 2015 - 2019
Intelligent Robotics Group and Robust Software Engineering — Moffet Field, CA

University of California, Berkeley — Graduate Student Researcher
Dept. of Mechanical Engineering — 2012-2019
Berkeley Emergent Space Tensegrities Lab (*PI: Alice Agogino*) — 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

**In addition to these independent awards and grants, Drew has assisted in writing three large multiple-PI proposals (NSF), one large single-PI proposal (NASA), and two small single-PI proposals.*

PEER-REVIEWED PUBLICATIONS

12. Inverse Statics Optimization for Compound Tensegrity Robots. Sabelhaus, A.P.; Li, A.H.; Sover, K.A.; Madden, J.; Barkan, A.; Agogino, A.K.; Agogino, A.M.; *IEEE Robotics and Automation Letters*, To Appear, 2020. Preprint available, arXiv:1808.08252
11. Model-Predictive Control with Inverse Statics Optimization for Tensegrity Spine Robots. Sabelhaus, A.P.; Zhao, H.; Zhu, E.; Agogino, A.K.; Agogino, A.M.; *IEEE Transactions on Control System Technology*, To Appear, 2020. Preprint available, arXiv:1806.08868

10. Modular Elastic Lattice Platform for Rapid Prototyping of Tensegrity Robots. Chen, L-H.; Daly, M.C.; Sabelhaus, A.P.; Janse van Vuuren, L.A.; Garnier, H.J.; Verdugo, M.I.; Tang, E.; Spangenberg, C.U.; Ghahani, F.; Agogino, A.K.; Agogino, A.M.; *ASME International Design Engineering Technical Conferences (IDETC) / 41st Mechanisms and Robotics Conference*, Aug 2017.

9. Model-Predictive Control of a Flexible Spine Robot. Sabelhaus, A.P.; Akella, A.K.; Ahmad, Z.A.; SunSpiral, V.; *American Control Conference (ACC)*, IEEE, May 2017.

8. DNA-Structured Linear Actuators. Zampaglione, K.; Sabelhaus, A.P.; Chen, L.; Agogino, A.M.; Agogino, A.K.; *ASME International Design Engineering Technical Conferences (IDETC) / 40th Mechanisms and Robotics Conference*, Aug 2016.

7. Mechanism Design and Simulation of the ULTRA Spine, a Tensegrity Robot. Sabelhaus, A.P.; Ji, H.; Hylton, P.; Madaan, Y.; Yang, C.; Friesen, J.; SunSpiral, V.; Agogino, A.M.; *ASME International Design Engineering Technical Conferences (IDETC) / 39th Mechanisms and Robotics Conference*, Aug 2015.

6. System Design and Locomotion of SUPERball, an Untethered Tensegrity Robot. Sabelhaus, A.P.; Bruce, J.; Caluwaerts, K.; Manovi, P.; Fallah Firoozi, R.; Dobi, S.; Agogino, A.M.; SunSpiral, V.; *IEEE International Conference on Robotics and Automation (ICRA)*, May 2015.

5. Design and Control of Compliant Tensegrity Robots through Simulation and Hardware Validation. Caluwaerts, K.; Despraz, J.; Iscen, A.; Sabelhaus, A.P.; Bruce, J.; Schrauwen, B.; SunSpiral, V.; *Journal of the Royal Society Interface*, Sept. 2014.

4. Hardware Design and Testing of SUPERball, a Modular Tensegrity Robot. Sabelhaus, A.P.; Bruce, J.; Caluwaerts, K.; Chen, Y.; Lu, D.; Liu, Y.; Agogino, A.K.; SunSpiral, V.; Agogino, A.M.; *The 6th World Conference on Structural Control and Monitoring (6WCSCM)*, July 2014

3. SUPERball: Exploring Tensegrities for Planetary Probes. Bruce, J.; Sabelhaus, A.P.; Chen, Y.; Lu, D.; Morse, K.; Milam, S.; Caluwaerts, K.; Agogino, A.M.; SunSpiral, V.; *12th International Symposium on Artificial Intelligence, Robotics, and Automation in Space (i-SAIRAS)*, June 2014

2. Design and Evolution of a Modular Tensegrity Robot Platform. Bruce, J.; Caluwaerts, K.; Iscen, A.; Sabelhaus, A.P.; SunSpiral, V.; *IEEE International Conference on Robotics and Automation (ICRA)*, May 2014

1. TinyTeRP: A Tiny Terrestrial Robotic Platform with Modular Sensing. Sabelhaus, A.P.; Mirsky, D.; Hill, L.M.; Bergbreiter, S.; *IEEE International Conference on Robotics and Automation (ICRA)*, May 2013

PRE-PRINTS + PUBLICATIONS UNDER REVIEW

1. Design, Simulation, and Testing of a Flexible Actuated Spine for Quadruped Robots. Sabelhaus, A.P.; Janse van Vuuren, L.A.; Joshi, A.; Zhu,E.; Garnier, H.J.; Sover, K.A.; Navarro, J.; Agogino, A.K.; SunSpiral, V.; Agogino, A.M.; *Preprint Only.* Available, arXiv:1804.06527

IN-PREPARATION PUBLICATIONS

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

PATENTS

2. DNA Structured Linear Actuator. Agogino, A.; Zampaglione, K.; Chen, L-H.; Sabelhaus, A.; US Patent Application Number: PCT/US2016/032899. Under Review.

1. Elastic Lattices for Design of Tensegrity Structures and Robots. Chen, L-H.; Agogino, A.; Daly, M.; Sabelhaus, A.P.; Agogino, A.K.; US Patent Application Number forthcoming, WIPO Publication Number: WO 2018/161089. Under Review.

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 Commitee (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.
- ASEE 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) Incoporated. 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.