Andrew P. Sabelhaus

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EDUCATION

PH.D. MECHANICAL ENGINEERING — University of California, Berkeley
Dissertation title: *Tensegrity Spines for Quadruped Robots* — 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
Thesis Committee: *Alice M. Agogino, Dennis Lieu*

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

APPOINTMENTS

Boston University	Assistant Professor
Department of Mechanical Engineering	2022 - Present
Division of Systems Engineering	2022 - Present
Center for Information Systems and Engineering	2022 - Present
Carnegie Mellon University	Postdoctoral Research Fellow
Deptartment of Mechanical Engineering	2019 - 2021
NASA Ames Research Center	Visiting Technologist
Intelligent Systems Division	2015 - 2019
University of California, Berkeley	Graduate Research Fellow
Department of Mechanical Engineering	2012-2019

FUNDING + AWARDS

6. NRO Architecture After Next, Research Grant. National Reconnaissance Office. Title: *Soft Robot Proprioception with Space-Compatible Artificial Muscles.* $210,459. 2023-2024.
5. NSF Cyberinfrastructure for Sustained Scientific Innovation (CSSI), Research Grant. National Science Foundation. Title: *Discrete Simulation of Flexible Structures and Soft Robots.* $169,987. 2022-2025.
4. Intelligence Community Postdoctoral Research Fellowship. Office of the Director of National Intelligence. Title: *Rapid Deployment of Hard-to-Control Robots with Optimality Tradeoffs.* Full funding, 2020-2022.
3. NASA Space Technology Research Fellowship. National Aeronautics and Space Administration. Title: *Trajectory Tracking in Nonlinear, High-Order, Underactuated Robotic Systems.* Full funding, 2015-2019.
2. CITRIS Tech for Social Good Development Grant. University of California Center for Information Technology Research in the Interest of Society (CITRIS). Title: *Laika, The Robot Transport for Disaster Relief.* Block grant, 2018.
1. NSF Graduate Research Fellowship. National Science Foundation. Full funding, 2012-2015.

RESEARCH OUTPUT SNAPSHOT

Peer-Reviewed Publication Count:				Total Citations:	h-index:
	Conference:	Journal:	Total:		
1st-Author or PI:	7	4	12	928* (394†)	15* (9†)
All:	12	10	22		

**Via Google Scholar, https://scholar.google.com/citations?user=ze69yEMAAAAJ&hl=en.*
†Via Web of Science, https://www.webofscience.com/wos/author/record/1791313.

JOURNAL PUBLICATIONS

10. X. Huang, Z.J. Patterson, A.P. Sabelhaus, W. Huang, K. Chin, Z. Ren, M.K. Jawed, C. Majidi, ``Design and Closed Loop Motion Planning of an Untethered Swimming Soft Robot using 2D Discrete Elastic Rods Simulations,'' *Advanced Intelligent Systems*, 2200163, 2022. doi:10.1002/aisy.202200163
9. X. Huang, A.P. Sabelhaus, M. K. Jawed, L. Jin, J. Zou, Y. Chen,``Materials, design, modeling and control of soft robotic artificial muscles,'' *Frontiers in Robotics and AI*, Vol. 30, Nov 2022. doi:10.3389/frobt.2022.1074549
8. A.P. Sabelhaus, R.K. Mehta, A. Wertz, C. Majidi, ``In-Situ Sensing and Dynamics Predictions for Electrothermally-Actuated Soft Robot Limbs,'' *Frontiers in Robotics and AI*, Vol. 9, May 2022. doi:10.3389/frobt.2022.888261
7. M. Zadan, D.K. Patel, A.P. Sabelhaus, J.Liao, A. Wertz, L. Yao, C. Majidi, ``Liquid Crystal Elastomer with Integrated Soft Thermoelectrics for Shape Memory Actuation and Energy Harvesting,'' *Advanced Materials*, April 2022. doi:10.1002/adma.202200857
6. Z.J. Patterson, A.P. Sabelhaus, C. Majidi, ``Robust Control of a Multi-Axis Shape Memory Alloy-Driven Soft Manipulator,'' *IEEE Robotics and Automatics Letters*, April 2022. doi:10.1109/LRA.2022.3143256
5. A.P. Sabelhaus, K. Zampaglione, E. Tang, L.H. Chen, A.K. Agogino, A.M. Agogino, ``Double-Helix Linear Actuators.'' *Journal of Mechanical Design (ASME)*, Vol. 143, Issue 10, Oct. 2021. doi:10.1115/1.4050739
4. Z. Ren, X. Huang, M. Zarepoor, A.P. Sabelhaus, C. Majidi, ``Shape Memory Alloy (SMA) Actuator with Embedded Liquid Metal Curvature Sensor for Closed-Loop Control.'' *Frontiers in Robotics and AI*, Vol. 8, Mar. 2021. doi:10.3389/frobt.2021.599650
3. 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*, Vol. 29, Issue 1, Jan. 2021. doi:10.1109/TCST.2020.2975138
2. 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*, July 2020. doi:10.1109/LRA.2020.2983699
1. 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*, Sept. 2014. doi:10.1098/rsif.2014.0520

CONFERENCE PUBLICATIONS

12. A. Wertz*, A.P. Sabelhaus*, C. Majidi, ``Trajectory Optimization for Thermally-Actuated Soft Planar Robot Limbs,'' *IEEE International Conference on Soft Robotics (RoboSoft)*, April 2022. *Equal Contribution. doi:10.1109/RoboSoft54090.2022.9762226
11. A.P. Sabelhaus, C.Majidi, ``Gaussian Process Dynamics Models for Soft Robots with Shape Memory Actuators.'' *IEEE International Conference on Soft Robotics (RoboSoft)*, April 2021. doi:10.1109/RoboSoft51838.2021.9479294
10. Z. Patterson, A.P. Sabelhaus, K. Chin, T. Hellebrekers, C. Majidi, ``An Untethered Brittle Star Robot for Closed-Loop Underwater Locomotion.'' *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2020. doi:10.1109/IROS45743.2020.9341008
9. 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
8. 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
7. 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
6. 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

5. 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

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

UNDER REVIEW + PRE-PRINTS

3. R. Jing, M. Anderson, M. Ianus-Valdivia, A. Akber, C. Majidi, A.P. Sabelhaus, ``Safe Balancing Control of a Soft Legged Robot.'' *Under Review.* arXiv:2209.13715

2. A.P. Sabelhaus, Z. Patterson, A. Wertz, C. Majidi, ``Safe Supervisory Control of Soft Robot Actuators.'' *Under Review.* arXiv:2208.01547

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.* arXiv:1804.06527

IN-PREPARATION

3. J.C. Pacheco Garcia, M.L. Anderson, R. Jing, M. Ianus-Valdivia, A.P. Sabelhaus, ``Pose Estimation of Thermally-Actuated Soft Robots Using Discretized Rigid Approximations.''

2. A.P. Sabelhaus, L.A. Janse van Vuuren, D. Macri, A. Joshi, K.A. Sover, Z. Rodriquez, J. Navarro, A. Bronars, A.H. Li, A. Barkan, A. Zhang, A.K. Agogino, A.M. Agogino, ``Tensegrity Spines for Quadruped Robots.''

1. A.P. Sabelhaus, ``Stability and Control Design for Lagrangian Systems with Statically-Conservative Forces.''

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*.

TALKS + PRESENTATIONS + POSTERS

23. A.P. Sabelhaus, ``Challenges in Control and Autonomy for Soft Robots: Robustness, Scalability, and Safety.'' *Embodied Intelligence Conference*, 2023

22. A.P. Sabelhaus, ``Controlling Soft Robots: Not as Hard as You'd Think.'' *University of Massachusetts Amherst, Department of Mechanical Engineering Seminar*, 2022

21. R. Jing, M.L. Anderson, M. Ianus-Valdivia, A.P. Sabelhaus, ``Safe Balancing Control of a Soft Legged Robot.'' *Northeast Regional Robotics Colloquium*, 2022

20. A.P. Sabelhaus, ``Safe Supervisory Control of Soft Robot Actuators.'' *Northeast Regional Robotics Colloquium*, 2022

19. A.P. Sabelhaus, ``Controlling Soft Robots: Not as Hard as You'd Think.'' *Applied Materials, Inc. Research Seminar Series*, 2022

18. A.P. Sabelhaus, ``Safe Supervisory Control of Soft Robot Actuators.'' *Robotics: Science and Systems, Workshop: The Science of Bumping Into Things, Towards Robots that Aren't Afraid of Contact*, 2022
17. A.P. Sabelhaus, ``Close Enough is Good Enough: Approximations in Soft Robot Control.'' *Embodied Intelligence Conference*, 2022
16. A.P. Sabelhaus, ``Double-Helix Linear Actuators.'' *4th ASME Journal of Mechanical Design Webinar*, American Society of Mechanical Engineers, Dec. 2021
15. A.P. Sabelhaus, ``Soft Robot Locomotion: Not as Hard as You Might Think.'' *Intelligence Community Academic Research Syposium*, United States Office of the Director of National Intelligence, Sept. 2021.
14. A.P. Sabelhaus, ``Controlling Soft Robots: Not as Hard as You Might Think.'' *NGA IC Postdoc Speaker Series*, National Geospatial Intelligence Agency (Online), June 2021.
13. A.P. Sabelhaus, ``Towards Rich Locomotion Gaits for Soft Robots.'' *CMU Locomotion Seminar*, Carnegie Mellon University, Nov. 2020.
12. A.P. Sabelhaus, C. Majidi, ``Gaussian Process Models for Soft Robot Locomotion.'' *Workshop on Application-Oriented Modeling and Control of Soft Robots, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2020.
11. A.P. Sabelhaus, ``Tensegrity Spines for Quadruped Robots.'' *Workshop on Tensegrity Robotics, IEEE International Conference on Robotics and Automation (ICRA)*, May 2019.
10. A.P. Sabelhaus, ``Tensegrity Spines for Quadruped Robots.'' *CMU Locomotion Seminar*, Carnegie Mellon University, Feb. 2019.
9. A.P. Sabelhaus, ``Laika and Belka: Walking Robots with Flexible Spines.'' *Workshop on Autonomy for Future NASA Science Missions*, National Aeronautics and Space Administration, Oct. 2018.
8. A.P. Sabelhaus, A.K. Agogino, ``Inverse Kinematics for Tensegrity Soft Robot Control: Existence and Optimality.'' *Soft Robotics Modeling and Control Workshop, IEEE/RSJ International Conference on Intelligent Robots and Systems*, Oct. 2018.
7. A.P. Sabelhaus, ``Laika, The Four-Legged Robot with a Flexible Spine.'' *NASA Space Technology Day-On-The-Hill*, United States Congress / House of Representatives, Nov. 2017.
6. A.P. Sabelhaus, ``Laika, The Quadruped Robot with a Flexible Spine.'' *Bay Area Robotics Symposium (BARS)*, Oct. 2017.
5. A.P. Sabelhaus, ``Trajectory Tracking Control of a Flexible Spine Robot.'' *Workshop on Structurally Adaptive Tensegrity Robotics, 13th NASA/ESA Conference on Adaptive Hardware and Systems*, July 2017.
4. A.P. Sabelhaus, ``UC Berkeley Robotics for Disaster Relief.'' *Field Innovation Team Bootcamp 5.0*, Mar. 2017.
3. A.P. Sabelhaus, ``DNA-Structured Linear Actuators.'' *SKTA Innopartners IP Redux*, Apr. 2016.
2. A.P. Sabelhaus, ``The ULTRA Spine Project.'' *Bay Area Robotics Symposium (BARS)*, Oct. 2015.
1. A.P. Sabelhaus, ``Robotics, Mechatronics, and Intelligent Systems.'' *Osher Lifelong Learning Institute*, Feb. 2014.

PROFESSIONAL ACTIVITIES

- Editorial Work: Associate Editor
  - *IEEE International Conference on Robotics and Automation (ICRA)*: Humanoids and Animaloids topic area. 2023
- Editorial Work: Guest Editor
  - *Frontiers in Robotics and AI*: Special Topic on Materials, Design, Modeling and Control of Soft Robotic Artificial Muscles. 2022
- Peer Review: Grant Proposals
  - National Science Foundation (NSF) Panel Reviewer, 2023
- Peer Review: Journals and Conferences
  - Journals: *Soft Robotics*, *IEEE Robotics and Automation Letters (RA-L)*, *Mechanism and Machine Theory*, *Acta Astronautica*, *IEEE Transactions on Control System Technology (T-CST)*, *IEEE Transactions on Robotics (T-RO)*, *Journal of Open-Source Software (JOSS)*, *Frontiers in Robotics and AI*, *IEEE Robotics and Automation Magazine*, *International Journal of Space Structures (IJSS)*.

- Conferences: *IEEE International Conference on Robotics and Automation (ICRA)*, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, *American Control Conference (ACC)*, *IEEE International Conference on Soft Robotics (RoboSoft)*, *IEEE RAS/EMBS International Conference on Biomedical Robotics & Biomechatronics (BioRob)*, *ASME International Design Engineering Technical Conference (IDETC)*, *IEEE Conference on Control Technology and Applications (CCTA)*, *IEEE/ASME Advanced Intelligent Mechatronics (AIM)*.

TEACHING + MENTORING

- **Mentorship of PhD students.** 3 students. Diversity: 2/3 identify as minority or under-represented, 66%.
- **Mentorship of master's students.** 17 students. Diversity: 9/17 identify as minority or under-represented, 53%.
- **Mentorship of undergraduate students.** 18 students. Diversity: 12/18 identify as minority or under-represented, 66%.
- **Instructor / Assistant Professor.** Boston University.

  - Spring 2023 | Eng. 103, Computational Linear Algebra | In Progress
  - Spring 2022 | Eng. 103, Computational Linear Algebra | Overall rating: 4.54/5
- **Graduate Student Instructor (GSI).** University of California, Berkeley.

  - Spring 2018 | Mech. Eng. 135/235, Design of Microprocessor-Based Mechanical Systems
- **Outstanding Graduate Student Instructor (GSI) Award.** University of California, Berkeley, 2019

DIVERSITY + OUTREACH + SERVICE

- **Service to the Systems Engineering Division at Boston University:**
  - Graduate Admissions Committee, 2022-2023
- **Faculty Advisor.** Out in Science, Technology, Engineering, and Mathematics (oSTEM)† at Boston University, 2022 - present
- **Faculty/Staff Advisor.** Out in Science, Technology, Engineering, and Mathematics (oSTEM)† at Carnegie Mellon University, 2020 - 2022.
- **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. 2018 - 2020.
- **Graduate Student Search Committee, Member.** UC Berkeley Mechanical Engineering Faculty Searches. 2017 - 2018.
- **Graduate Peer Advisor.** UC Berkeley Mechanical Engineering - Equity, Diversity, and Inclusion Initiative. 2014 - 2015.
- **Coordinator, Chapter Leadership Programs.** Out in Science, Technology, Engineering, and Mathematics† Incoporated. 2012 - 2013.
- **Single Outreach Events (Selected):**
  - NASA Downlink Day, Boston University, 2022: Demo and Lab Tour
  - LGBTQ Professionals in STEM Panel, Boston University, 2022: Panelist
  - NASA High School Camp at Carnegie Mellon University, 2021: Guest lecture
  - Carnegie Science Center Day, 2020: Organized table presentation
  - Cal Day, UC Berkeley, 2015-2019: Organized lab tours
  - Robot Block Party, Silicon Valley Robotics, 2015, 2017: Organized table presentation

†Out in Science, Technology, Engineering, and Mathematics (oSTEM) is a national organization for LGBTQ science and engineering students, www.ostem.org

PROFESSIONAL DEVELOPMENT

- **Essentials of Effective Instruction.** American Society for Engineering Education (ASEE). Intensive course on active learning and theory of teaching and learning for new instructors. Sept. 2021.
- **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.