Dr. Elliot Wright Hawkes

Associate Professor
University of California, Santa Barbara
ewhawkes@engineering.ucsb.edu

Education

Stanford University, Stanford, CA

Ph.D. in Mechanical Engineering with Prof. Mark Cutkosky (2015)
Thesis: "Applying Gecko Adhesives to the Real World."
M.S. in Mechanical Engineering, GPA: 4.07 (2011)

Harvard University, Cambridge, MA

A.B. in Mechanical Engineering, Highest Honors, GPA: 3.83, Concentration GPA: 3.88/4
Secondary in Organismic and Evolutionary Biology, Biomechanics (2009)
Thesis: "Paradigm for Building Multi-functional Composite Structures with Embedded Actuation."

Positions Held

Hawkes Lab 07/17-present
University of California, Santa Barbara
Associate Professor, 2022-present
Assistant Professor, 07/17-06/2022

Collaborative Haptics And Robotics in Medicine Laboratory, 07/16-6/17
Stanford University, with Prof. Allison Okamura
Visiting Assistant Professor
-Soft growing robotics device; stroke rehab device

Collaborative Haptics And Robotics in Medicine Laboratory, 07/15-7/16
Stanford University, with Prof. Allison Okamura
Postdoctoral Scholar
-Pneumatic artificial muscle capable of 400% strain, robotic devices capable of growth.

Biomimetic and Dextrous Manipulation Laboratory, 12/09-06/15
Stanford University, with Prof. Mark Cutkosky
PhD Candidate
-Performance of gecko-inspired adhesives: ankle mechanism for robotic climbing, surface grasping mechanism for perching, soft mechanism for *grasping without squeezing,* world's

smallest climbing robot capable of hoisting 100x bodyweight, human climbing on vertical surfaces with dry adhesive.

Romotive, Inc. 1/12-3/13

Design Consultant

-iPhone mobile robot; DFM injection molding and line assembly, 10,000 cycles minimum life, robust to 2m drop test, positive user experience.

Square One Robotics 7/12

Design Consultant

-Design of robotic gripper for grasping rock with microspines.

Harvard Microrobotics Laboratory, 8/07-8/09

Harvard University, with Prof. Robert Wood

Undergraduate Research Assistant

-Smart composite material with embedded actuation, self-folding origami, milli-scale robotic swimmer, shape memory alloy artificial muscles.

Multi-scale Robotics Laboratory, 6/08-8/08

Swiss Federal Institute of Technology, with Prof. Bradley Nelson

Herschel Smith Fellow

-Capsule-sized endoscopic microrobots, introduced Smart Composite Microstructure manufacturing at Institute of Robotics and Intelligent Systems.

Quad Bikes, Non-Profit Community Bicycle Shop, Cambridge, MA 9/06-8/09

Mechanic

-Repaired, refurbished, and built bikes at a local shop, 10-12 hr/wk.

National High Magnetic Field Laboratory, 6/07-8/07

Florida State University, with Prof. Irinel Chiorescu

National Science Foundation Research Experience for Undergraduates (REU)

-Interlocking sample holder for quantum chip experiments at 4mK and 10 Tesla.

Harvard Skeletal Biology Laboratory, 1/06-5/06

Harvard University, with Prof. Daniel Lieberman

Undergraduate Research Assistant

-Studied gluteus maximus function in trunk stabilization with EMG, force sensors, rate gyros.

Awards and Honors

-Presidential Early Career Award in Science and Engineering (PECASE) 2025, President Biden
-Mechanical Engineering Outstanding Faculty Award 2022-23
-Article selected for cover highlight, *Nature* 2022
-IEEE RAS Early Academic Career Award in Robotics and Automation 2021
-Northrop Grumman Excellence in Teaching Award 2020-2021
-IEEE IROS Best Paper Award Finalist 2021
-Article selected for cover of *Science Robotics* 2021
-IEEE RAM Best Paper Award 2020
-NASA Early Career Faculty Award 2020
-Packard Foundation Fellowship 2020
-NSF Faculty Early Career Development Program (CAREER) Award 2020
-IEEE Transactions on Robotics Best Paper Award for 2018
-Best Paper Award Finalist, Journal of Experimental Biology 2019
-Most Read Research Papers of the Year, J. Experimental Biology (awarded to 3 papers) 2019
-Mechanical Engineering Outstanding Faculty Award 2018-19
-AAAS Top Ten Robotics Technologies of the Year for 2018
-Top 100 Technologies of the Year, Discover Magazine, 2018
-Article selected for cover of *Science Robotics* 2017
-Best Student Paper Award, IEEE ICRA 2015
-ASME Best Journal Paper Award in Bioinspired Systems and Materials 2015
-JRSI article Ranked by Altmetrics #1 of 952 articles from JRSI, top 5% of all time
-Best Paper Award IEEE, IROS 2015
-Invited to exhibit work at TED2015
-Best Student Paper Award Finalist, IEEE ICRA 2014
-National Science Foundation Graduate Research Fellowship Program, 2012-2014
-National Defense Science and Engineering Graduate fellowship, 2009-2012
-Highest Honors, Harvard School of Engineering and Applied Sciences, 2009
-Phi Beta Kappa, 2009
-Rhodes Scholarship Finalist, 2008

Publications

Articles in Archival Journals

1. Xiao, C., Liao, B. and **Hawkes, E.W.,** 2024. Passively adaptive radiative switch for thermoregulation in buildings. *Device*, *2*(1).

2. Girerd, C., Alvarez, A., **Hawkes, E.W.** and Morimoto, T.K., 2024. Material Scrunching Enables Working Channels in Miniaturized Vine-Inspired Robots. *IEEE Transactions on Robotics*.

3. Heap, W.E., Man, S., Bassari, V., Nguyen, S., Yao, E.B., Tripathi, N.A., Naclerio, N.D. and **Hawkes, E.W.,** 2024. Large-Scale Vine Robots for Industrial Inspection: Developing a New Framework to Overcome Limitations With Existing Inspection Methods. *IEEE Robotics & Automation Magazine*.

4. Haggerty, D.A., Banks, M.J., Kamenar, E., Cao, A.B., Curtis, P.C., Mezić, I. and **Hawkes, E.W.**, 2023. Control of soft robots with inertial dynamics. *Science robotics*, *8*(81), p.eadd6864.

5. Deglurkar, S., Xiao, C., Gockowski, L., Valentine, M.T. and **Hawkes, E.W.,** 2023. A light- and heat-seeking vine-inspired robot with material-level responsiveness. *IEEE Robotics and Automation Letters*.

6. Zhu, M., Ferstera, A., Dinulescu, S., Kastor, N., Linnander, M., **Hawkes, E.W.** and Visell, Y., 2023. A peristaltic soft, wearable robot for compression therapy and massage. *IEEE Robotics and Automation Letters*, *8*(8), pp.4665-4672.

7. Stroppa, F., Selvaggio, M., Agharese, N., Luo, M., Blumenschein, L.H., **Hawkes, E.W.** and Okamura, A.M., 2023. Shared-control teleoperation paradigms on a soft-growing robot manipulator. *Journal of Intelligent & Robotic Systems*, *109*(2), p.30.

8. Zhu, M., Biswas, S., Dinulescu, S.I., Kastor, N., **Hawkes, E.W.** and Visell, Y., 2022. Soft, Wearable Robotics and Haptics: Technologies, Trends, and Emerging Applications. *Proceedings of the IEEE*, *110*(2), pp.246-272.

9. **Hawkes, E.W.,** Xiao, C., Peloquin, R.A., Keeley, C., Begley, M.R., Pope, M.T. and Niemeyer, G., 2022. Engineered jumpers overcome biological limits via work multiplication. *Nature*, *604*(7907), pp.657-661.

10. Heap, W.E., Keeley, C.T., Yao, E.B., Naclerio, N.D. and **Hawkes, E.W**., 2022. Miniature, Lightweight, High-Force, Capstan Winch for Mobile Robots. *IEEE Robotics and Automation Letters*, *7*(4), pp.9873-9880.

11. Blumenschein, L.H., Koehler, M., Usevitch, N.S., **Hawkes, E.W.**, Rucker, D.C. and Okamura, A.M., 2021. Geometric solutions for general actuator routing on inflated-beam soft growing robots. *IEEE Transactions on Robotics*, *38*(3), pp.1820-1840.

12. **Hawkes, E.W.,** Majidi, C. and Tolley, M.T. (2021). Hard questions for soft robotics. *Science Robotics*, *6*(53).

13. Naclerio, N.D., Karsai, A., Murray-Cooper, M., Ozkan-Aydin, Y., Aydin, E., Goldman, D., and **Hawkes, E.W.** (2021). Controlling subterranean forces to enable a fast, steerable, burrowing soft robot. *Science Robotics, In Press (to be published June15, 2021).*

14. Haggerty, D.A., Naclerio, N. and **Hawkes, E.W.** (2021). Hybrid vine robot with internal Steering-Reeling Mechanism enhances system-level capabilities. *IEEE Robotics and Automation Letters*.

15. Li, M., Obregon, R., Heit, J.J., Norbash, A., **Hawkes, E.W.** and Morimoto, T.K. (2021). VINE Catheter for Endovascular Surgery. *IEEE Transactions on Medical Robotics and Bionics*.

16. Taylor, I., Lehner, K., McCaskey, E., Nirmal, N., Ozkan-Aydin, Y., Murray-Cooper, M., Jain, R., **Hawkes, E.W.**, Ronald, P.C., Goldman, D.I. and Benfey, P.N. (2021). Mechanism and function of root circumnutation. *Proceedings of the National Academy of Sciences*, *118*(8).

17. Martinez, A., DeJong, J., Akin, I., Aleali, A., Arson, C., Atkinson, J., ...**Hawkes, E.W**., … & Zheng, J. (2021). Bio-inspired geotechnical engineering: Principles, current work, opportunities and challenges. *Géotechnique*, 1-48.

18. Suresh, S.A., Hajj-Ahmad, A., **Hawkes, E.W.** and Cutkosky, M.R. (2021). Forcing the issue: testing gecko-inspired adhesives. *Journal of the Royal Society Interface*, *18*(174), p.20200730.

19. Lee, J., Sroda, M.M., Kwon, Y., El-Arid, S., Seshadri, S., Gockowski, L.F., **Hawkes, E.W.**, Valentine, M.T. and Read de Alaniz, J. (2020). Tunable Photothermal Actuation Enabled

by Photoswitching of Donor–Acceptor Stenhouse Adducts. *ACS Applied Materials & Interfaces*, *12*(48), pp.54075-54082.

20. Hao, Y., Biswas, S., **Hawkes, E.W.,** Wang, T., Zhu, M., Wen, L. and Visell, Y. (2020). A Multimodal, Enveloping Soft Gripper: Shape Conformation, Bioinspired Adhesion, and Expansion-Driven Suction. *IEEE Transactions on Robotics*.

21. Simpson, C., Huerta, B., Sketch, S., Lansberg, M., **Hawkes, E.W**. and Okamura, A. (2020). Upper extremity exomuscle for shoulder abduction support. *IEEE Transactions on Medical Robotics and Bionics*, *2*(3), pp.474-484.

22. Fanton, M., Alizadeh, H., Domel, A., Devlin, M., Kurt, M., Mungal, G., Camarillo, D. and **Hawkes, E.W**. (2020). "Variable area, constant force shock absorption motivated by traumatic brain injury prevention." *Smart Materials and Structures, 29 (8) 085023.*

23. Usevitch*, N.S., Hammond*, Z.M., Schwager, M., Okamura, A.M., **Hawkes**, E.W.** and Follmer**, S. (2020) An untethered isoperimetric soft robot. *Science Robotics*, *5*(40). **contributed equally **contributed equally*

24. Naclerio, N., and **Hawkes, E.W**. (2020) Simple, Low-hysteresis, Foldable, Fabric Pneumatic Artificial Muscle. *IEEE Robotics and Automation Letters.*

25. Blumenschein, L.H., Coad, M.M., Haggerty, D.A., Okamura, A.M. and **Hawkes, E.W.** (2020). Design, modeling, control, and application of everting vine robots. *Frontiers in Robotics and AI*, *7*.

26. Greer, J. D., Blumenschein, L. H., Alterovitz, R., **Hawkes, E. W.**, & Okamura, A. M. (2020). Robust navigation of a soft growing robot by exploiting contact with the environment. *The International Journal of Robotics Research*, *39*(14), 1724-1738.

27. Zhu, M., Do, T.N., **Hawkes, E.W.** and Visell, Y. (2020) Fluidic fabric muscle sheets for wearable and soft robotics. *Soft Robotics*. **Cover Article.**

28. Coad, M., Thomasson, R., Blumenschein, L., Usevitch, N., **Hawkes, E.W.**, and Okamura, A.O. Retraction of soft growing robots without buckling. *IEEE Robotics and Automation Letters* 5, no. 2 (2020): 2115-2122.

29. Gan, L.T., Blumenschein, L.H., Huang, Z., Okamura, A.M., **Hawkes, E.W.** and Fan, J.A., 2020. 3D Electromagnetic Reconfiguration Enabled by Soft Continuum Robots. *IEEE Robotics and Automation Letters*, *5*(2), pp.1704-1711.

30. Simpson, C., Welker, C., Jackson, R., Uhlrich, S., Sketch, S., Collins, S., Delp, S., Selinger, J., and **Hawkes, E.W.** Connecting the legs with a spring improves human running economy. Journal of Experimental Biology, 2019. **Best Paper Award Finalist, Cover Article.**

31. Suresh, S.A., Kerst, C.F., Cutkosky, M.R. and **Hawkes, E.W**., 2019. Spatially variant microstructured adhesive with one-way friction. *Journal of the Royal Society Interface*, *16*(150), p.20180705.

32. Naclerio, N., Kerst, C., Haggerty, D., Suresh, S., Singh, S., Ogawa, K., Miyazaki, S., Cutkosky, M., and **Hawkes, E.W**. Low-cost, Continuously Variable, Strain Wave Transmission Using Gecko-inspired Adhesives. *IEEE Robotics and Automation Letters.* (2019).

33. Greer, J. D., Morimoto, T. K., Okamura, A. M., and **Hawkes, E. W.** A soft, steerable continuum robot that grows via tip extension. *Soft robotics*. (2019): *6*(1), 95-108.

34. Morimoto, T., Greer, J., Hsieh, M., Hawkes, E. W., and Okamura, A.M. "Toward the Design of Personalized Continuum Surgical Robots." *Annals of biomedical engineering, (2018)1-12.*

35. Hawkes, E.W., and Cutkosky, M.R. “Design of Materials and Mechanisms for Responsive Robots.” *Annual Review of Control, Robotics, and Autonomous Systems* (2018): 1, 359-384.

36. Morimoto, T., Hawkes, E. W., and Okamura, A.M. “Design of a Compact Actuation and Control System for Flexible Medical Robots." *IEEE Robotics and Automation Letters.* (2017).

37. Choi, I., Corson, N., Peiros, L., Hawkes, E.W., Keller, S., and Follmer, S. “A Soft, Controllable, High Force Density Linear Brake Utilizing Layer Jamming." *IEEE Robotics and Automation Letters.* (2017).

38. Blumenschein, L., Gan, L., Fan, J., Okamura, A.M., and Hawkes, E.W. “A Tip-Extending Soft Robot Enables Reconfigurable and Deployable Antennas." *IEEE Robotics and Automation Letters.* (2017): 3 (2), 949-956.

39. Hawkes, E.W., Christensen, D.L., Han, A.K., Jiang, H., and Cutkosky, M.R. “Grasping without Squeezing: Design and Modeling of Shear Adhesion Grasping.” *IEEE Trans. Robotics*. (2018): 34 (2), 303-316. TRO Best Paper Award.

40. Jiang, H., Hawkes, E.W., Fuller, C., Estrada, M.A., Suresh, S.A., Abcouwer, N., Han, A.K., Wang, S., Ploch, C.J., Parness, A., & Cutkosky, M.R. A robotic device using gecko-inspired adhesives can grasp and manipulate large objects in microgravity. *Science Robotics,* (2017): aan4545.

41. Hawkes, E.W., Christensen, D.L., Han, A.K., Jiang, H., and Cutkosky, M.R. “Grasping without Squeezing: Design and Modeling of Shear Adhesion Grasping.” *IEEE Trans. Robotics*. In Press.

42. Blumenschein, L., Gan, L., Fan, J., Okamura, A.M., and Hawkes, E.W. “A Tip-Extending Soft Robot Enables Reconfigurable and Deployable Antennas", *IEEE Robotics and Automation Letters.* Under Review.

43. Choi, I., Corson, N., Peiros, L., Hawkes, E.W., Keller, S., and Follmer, S. “A Soft, Controllable, High Force Density Linear Brake Utilizing Layer Jamming." *IEEE Robotics and Automation Letters.* (2017).

44. Hawkes, E.W., Blumenschein, L.H., Greer, J.D., and Okamura, A.M. “A Soft Robot that Navigates Its Environment through Growth.” *Science Robotics.* (2017): aan3028.

45. Morimoto, T., Hawkes, E. W., and Okamura, A.M. “Design of a Compact Actuation and Control System for Flexible Medical Robots." *IEEE Robotics and Automation Letters.* (2017).

46. Pope, M., Kimes, C.W., Jiang, H., Hawkes, E.W., Han, A.K., Christensen, D.L., and Cutkosky, M.R. “Robust Vertical Perching and Climbing Using Microspines.” *IEEE Trans. Robotics*. (2016).

47. Hawkes, E.W., Lentink, D. “Robots smaller than bumble bees can hover longer with flapping wings than with spinning wings.” *J. R. Soc. Interface*. (2016).

48. Hawkes, E.W., Christensen, D.L., Pope, M., and Cutkosky, M.R. “One Motor, Two Degrees of Freedom through Dynamic Response Switching.” *IEEE Robotics and Automation Letters.* (2015).

49. Thomas, J., Loianno, G., Pope, M., Hawkes, E.W., Estrada, M., Jiang, H., Cutkosky, M.R., and Kumar, V. “Aggressive Flight for Perching on Inclined Surfaces.” *ASME J. Mechanisms and Robotics*. (2015).

50. Hawkes, E.W., Jiang, H., and Cutkosky, M.R. “Three Dimensional Dynamic Surface Grasping with Dry Adhesion.” *Int. J. Robotics Research*. (2015): 0278364915584645.

51. Eason, E.V., **Hawkes, E.W.**, Windheim, M., Christensen, D.L., Libby, T. and Cutkosky, M.R., "Stress distribution and contact area measurements of a gecko toe using a high-resolution tactile sensor," *Bioinsipration & Biomimetics.* 10, no. 1 (2015): 016013.

52. Suresh, A., Christensen, D.L., **Hawkes, E.W.**, and Cutksoky, M.R. "Surface and Shape Deposition Manufacturing for the Fabrication of a Curved Surface Gripper." *ASME J. Mechanisms and Robotics*. 7, no. 2 (2015): 021005.

53. **Hawkes, E.W.,** Eason, E.V., Christensen, D.L., and Cutkosky, M.R. "Human Climbing with Efficiently Scaled Gecko-inspired Dry Adhesives." *J. R. Soc. Interface* (2014): 201512 20140675. **ASME Best Journal Paper Award in Bioinspired Systems and Materials.**

54. Pope, M., Lussier Desbiens, A., **Hawkes, E.W.**, Christensen, D., and Cutkosky, M.R. "Design Principles for Efficient, Repeated Jumpgliding." *J. Bioinspiration and Biomimetics*, 9, no. 2 (2014): 025009.

55. **Hawkes, E.W.,** Eason, E., Asbeck, A., and Cutkosky, M.R. "The Gecko's Toe: Scaling Dry Adhesives for Climbing Applications." *IEEE Trans. Mechatronics,* 18, no. 2 (2013): 518-526.

56. Stirling, L., Yu, C., **Hawkes, E.W.**, Miller, J., Wood, R.J., Goldfield, E., and Nagpal, R. "Applicability of shape memory alloy wire for an active, soft orthotic." *J. Mater. Eng. Perform.,* 20.4 (2011): 658–662.

57. Paik, J. K., **Hawkes, E.W.**, and Wood, R.J. "A novel low-profile shape memory alloy torsional actuator." *Smart Materials and Structures* 19.12 (2010) : 125014.

58. **Hawkes, E.W.**, An, B., Benbernou, N., Tanaka, H., Kim, S., Demaine, E., Rus, D., and Wood, R. J. "Programmable matter by folding." *Proc. Nat. Acad. Sci.,* 107.28 (2009): 12441-12445. **~600 Citations.**

59. Nagy, Z., Harada, K., Fluckiger, M., Susilo, E., Kaliakatsos, I.K., Menciassi, A., **Hawkes, E.W.**, Abbott, J.J., Dario, P., and Nelson, B.J. "Assembling Reconfigurable Endoluminal Surgical Systems: Opportunities and Challenges," *Int'l J. Biomechatronics and Biomedical Robotics (IJBBR),* 1.1 (2008): 3.

Refereed Conference Articles (Published)

60. Mendoza, M.J., Naclerio, N.D. and Hawkes, E.W., 2024, May. High-curvature, high-force, vine robot for inspection. In *2024 IEEE International Conference on Robotics and Automation (ICRA)* (pp. 3014-3021). IEEE.

61. Paul, S., Devlin, M.R. and Hawkes, E.W., 2024, May. A scalable, light-controlled, individually addressable, non-metal actuator array. In *2024 IEEE International Conference on Robotics and Automation (ICRA)* (pp. 684-690). IEEE.

62. Alvarez, A., Devlin, M., Naclerio, N., and Hawkes, E.W. Design and Modeling of Latch-Mediated, Spring-Actuated Air-Jumpers. In *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS).*

63. Devlin, M.R., Dickens, M.M., Xiao, C. and **Hawkes, E.W.,** 2021, September. SPHR: A Soft Pneumatic Hybrid Robot with extreme shape changing and lifting abilities. In *2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)* (pp. 6090-6096). IEEE.

64. Berdan, C.C., Johnson, B.G. and **Hawkes, E.W.,** 2021, September. Microspine-rubber composite for high friction on smooth, rough, and wet surfaces. In *2021 IEEE/RSJ*

International Conference on Intelligent Robots and Systems (IROS) (pp. 7384-7390). IEEE.

65. Heap, W.E., Naclerio, N.D., Coad, M.M., Jeong, S.G. and **Hawkes, E.W.**, 2021, September. Soft Retraction Device and Internal Camera Mount for Everting Vine Robots. In *2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)* (pp. 4982-4988). IEEE.

66. Drew, D.S., Devlin, M., **Hawkes, E.W.** and Follmer, S. (2021). Acoustic Communication and Sensing for Inflatable Modular Soft Robots. 2021 *IEEE Int'l. Conf. Robotics and Automation. Accepted.*

67. Murray-Cooper, M., Ozkan-Aydin, Y., Aydin, E., Naclerio, N., Mccaskey, E.N., **Hawkes, E.W.,** and Goldman, D. (2020). Robophysical Investigation of Root Nutation through Heterogeneous Environments. In *INTEGRATIVE AND COMPARATIVE BIOLOGY* (Vol. 60, pp. E169-E169).

68. Devlin, M.R. and Brad, T., Hawkes, E.W. (2020). An untethered soft cellular robot with variable volume, friction, and unit-to-unit cohesion. In *Proceedings of the 2020 IEEE-RSJ International Conference on Intelligent Robots and Systems*.

69. Wang, S., Zhang, R., Haggerty, D., Naclerio, N., and **Hawkes, E.W**. A Dexterous Tip-extending Robot with Variable-length Shape-locking. 2020 *IEEE Int'l. Conf. Robotics and Automation.*

70. Selvaggio, M., Ramirez, L., Siciliano, B., and **Hawkes, E.W.** An obstacle-interaction planning method for navigation of actuated vine robots. 2020 *IEEE Int'l. Conf. Robotics and Automation.*

71. Nguyen, A., Russell, A., Vuong,V., Naclerio, N., Huang, H., Chui, K., and **Hawkes, E.W**. A Tri-Stable Soft Robotic Finger Capable of Pinch and Wrap Grasps. 2020 *IEEE Int'l. Conf. Robotics and Automation.*

72. Evora, A., Sloan, E., Castellino, S., Susko, T., and **Hawkes, E.W.** Pilot Study of Cadence, a Novel Shoe for Patients with Foot Drop. 2019 *41st Annual International Conference of the IEEE Engineering in Medicine & Biology Society.*

73. Haggerty, D.A., Naclerio, N.D. and **Hawkes, E.W.** (2019). Characterizing environmental interactions for soft growing robots. In *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)* (pp. 3335-3342).

74. Xiao, C., Naclerio, N.D. and **Hawkes, E.W.** (2019). Energy Harvesting across Temporal Temperature Gradients using Vaporization. In *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)* (pp. 7170-7175).

75. Luong, J., Glick, P., Ong, A., deVries, M.S., Sandin, S., **Hawkes, E.W.** and Tolley, M.T. Eversion and Retraction of a Soft Robot Towards the Exploration of Coral Reefs. In *2019 2nd IEEE International Conference on Soft Robotics (RoboSoft)* (pp. 801-807).

76. Ozkan-Aydin, Y., Murray-Cooper, M., Aydin, E., McCaskey, E.N., Naclerio, N., **Hawkes, E.W.** and Goldman, D.I. Nutation Aids Heterogeneous Substrate Exploration in a Robophysical Root. In *2019 2nd IEEE International Conference on Soft Robotics (RoboSoft)* (pp. 172-177).

77. Naclerio, N.D., Hubicki, C.M., Aydin, Y.O., Goldman, D.I. and **Hawkes, E.W**. Soft robotic burrowing device with tip-extension and granular fluidization. In *2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)* (pp. 5918-5923).

78. El-Hussieny, H., Mehmood, U., Mehdi, Z., Jeong, S.G., Usman, M., **Hawkes, E.W.,** Okamura, A.M. and Ryu, J.H. Development and evaluation of an intuitive flexible interface for teleoperating soft growing robots. In *2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)* (pp. 4995-5002).

79. Greer, J.D., Blumenschein, L.H., Okamura, A.M., and **Hawkes, E.W.** "Obstacle aided

navigation of a soft growing robot." 2018 *IEEE Int'l. Conf. Robotics and Automation.*

80. Usevitch, N., Okamura, A.M., and **Hawkes, E.W.** "APAM: Antagonistic Pneumatic Artificial Muscle." 2018 *IEEE Int'l. Conf. Robotics and Automation.*

81. Mehdi, Z., Mehmood, U., Jeong, S., El-Hussieny, H., Hawkes, E.W., Okamura, A.M., and Ryu, J.H. "Development of an Intuitive Interface for Teleoperating Soft Growing Robots: A Subjective Study." 2018 *IEEE Int'l. Conf. Robotics and Automation.*

82. Agharese, N., Cloyd, T., Blumenschein, L.H., Raitor, M., **Hawkes, E.W.,** Culbertson, H., and Okamura, A.M. "HapWRAP: Soft Growing Wearable Haptic Device." 2018 *IEEE Int'l. Conf. Robotics and Automation.*

83. Slade, P., Gruebele, A., Hammond, Z., Raitor, M., Okamura, A.M., and **Hawkes, E.W.** "Design of a Soft Catheter for Low-Force and Constrained Surgery." *Int. Conf. Intelligent Robots and Systems,* (2017).

84. Simpson, C.S., Okamura, A.M., and **Hawkes, E.W.** "Exomuscle: An inflatable device for shoulder abduction support." *IEEE Int'l. Conf. Robotics and Automation.* (2017).

85. Greer, J.D., Morimoto, T., Okamura, A.M., and **Hawkes, E.W.** "Series Pneumatic Artificial Muscles (sPAMs) and Application to a Soft Continuum Robot." *IEEE Int'l. Conf. Robotics and Automation.* (2017).

86. Estrada, M., Jiang, H., Noll, B., **Hawkes, E.W.,** Pavone, M., and Cutkosky, M.R. "Force and Moment Constraints of a Curved Surface Gripper and Wrist for Assistive Free Flyers." *IEEE Int'l. Conf. Robotics and Automation.* (2017).

87. Usman, M., Suthar, B., Seong, H., **Hawkes, E.W.,** Gaponov, I., and Ryu, J.H. "Passive Returning Mechanism for Twisted String Actuators." *IEEE Int'l. Conf. Robotics and Automation.* (2017).

88. Hammond, Z., Usevitch, N., **Hawkes, E.W.**, and Follmer, S. "Pneumatic Reel Actuator: Design, Modeling, and Implementation." *IEEE Int'l. Conf. Robotics and Automation.* (2017).

89. **Hawkes, E.W.**, Christensen, D.L., and Okamura, A.M. "Design and Implementation of a 300% Strain Soft Artificial Muscle." 2016 *IEEE Int'l. Conf. Robotics and Automation.*

90. Estrada, M., Hockman, B., Bylard, A., **Hawkes, E.W.**, Cutkosky, M.R., and Pavone, M. "Free-Flyer Acquisition of Spinning Objects with Gecko-Inspired Adhesives." 2016 *IEEE Int'l Conf. Robotics and Automation.* In review.

91. Wu, X.A., Suresh, A.S., Jiang, H., Ulmen, J., **Hawkes, E.W.**, Christensen, D.L., and Cutkosky, M.R. "Tactile Sensing for Gecko-Inspired Adhesion." *IEEE Int. Conf. Intelligent Robotics and Automation,* (2015). **Best Paper Award.**

92. Jiang, H., Pope, M., Estrada, M., Edwards, B., Cuson, M., **Hawkes, E.W.**, and Cutkosky, M.R. "Perching Failure Detection and Recovery with Onboard Sensing," *Int. Conf. Intelligent Robots and Systems,* (2015).

93. **Hawkes, E.W.**, Christensen, D.L., Han, A.K., Jiang, H., and Cutkosky, M.R. "Grasping without Squeezing: Shear Adhesion Gripper with Fibrillar Thin Film," *IEEE Int'l. Conf. Robotics and Automation*, (2015). **Best Student Paper Award.**

94. **Hawkes, E.W.**, Christensen, D.L., and Cutkosky, M.R. "Vertical Dry Adhesive Climbing with a 100x Bodyweight Payload," *IEEE Int'l. Conf. Robotics and Automation*, (2015).

95. Jiang, H., **Hawkes, E.W.**, et al. "Scaling Controllable Adhesives to Grapple Floating Objects in Space," *IEEE Int'l. Conf. Robot. and Automation*, (2015).

96. Christensen, D.L, **Hawkes, E.W.**, and Cutkosky, M.R. "Tugs: Enabling Microrobots to Deliver Macro Forces with Controllable Adhesives," *IEEE Int'l. Conf. Robotics and Automation*, (2015).

97. Thomas, J., Loianno, G., Pope, M., **Hawkes, E.W.**, Estrada, M., Jiang, H., Cutkosky, M.R., and Kumar, V. "Planning and Control of Aggressive Maneuvers for Perching on Inclined or Vertical Surfaces." *ASME IDETC, (*2015): 025010.

98. Estrada, M., **Hawkes, E.W.**, Christensen, D., and Cutkosky, M.R. "Robust Landing, Perching and Vertical Climbing: Design of a Multimodal Robot," *IEEE Int'l. Conf. Robotics and Automation*, (2014): 4215-4221. **Best Student Paper Finalist.**

99. Winck, R. C., Sketch, S. M., **Hawkes, E. W.**, Christensen, D. L., Jiang, H., Cutkosky, M. R., and Okamura, A. M. "Time-delayed teleoperation for interaction with moving objects in space." *IEEE Int'l. Conf. Robotics and Automation*, (2014): 5952-5958.

100. Eason, E. V., **Hawkes, E. W.**, Windheim, M., Christensen, D. L., Libby, T., and Cutkosky, M. R. "Adhesive Stress Distribution Measurement on a Gecko." *In Biomimetic and Biohybrid Systems, Living Machines Conf.* (2014): 386-388.

101. Jiang, H., Pope, M., **Hawkes, E.W.**, Christensen, D., Estrada, M., and Cutkosky, M.R. "Modeling the Dynamics of Perching with Opposed-Grip Mechanisms," *IEEE Int'l. Conf. Robotics and Automation*, (2014): 3102-3108.

102. Seitz, B., Goldberg, B.,Doshi, N., Ozcan, O., Christensen, D., **Hawkes, E.W.**, Cutkosky,
M., and Wood, R.J. "Bio-inspired mechanisms for inclined locomotion in a legged insect-scale robot," *ROBIO,* (2014): 791-796.

103. **Hawkes, E.W.**, Christensen, D.L., and Cutkosky, M.R. "Dynamic surface grasping with directional adhesion," *Int. Conf. Intelligent Robots and Systems,* (2015): 5487-5493.

104. Christensen, D.L, **Hawkes, E.W.**, Wong-Foy, A., Pelrine, R.E., and Cutkosky, M.R., "Incremental Inspection for Microrobotic Quality Assurance," Proc. ASME 2013 IDETC/CIE, (2013): V001T09A030.

105. **Hawkes, E.W.**, Ulmen, J., Esparza, N., and Cutkosky, M.R. "Scaling Walls: Applying Dry Adhesives to the Real World." *Proc. of the IEEE Int. Conf. on Intelligent Robots and Systems*, (2011): 5100-5106.

106. Kim, S., **Hawkes, E.W.**, Cho, K., Joldaz, M., Foley, J., and Wood, R.J. "Micro artificial muscle fiber using niti spring for soft robotics," *Proc. of the IEEE Int. Conf. on Intelligent Robots and Systems*, (2009): 2228-34.

107. Cho, K., **Hawkes, E.W.**, Quinn, C., and Wood, R.J. "Design, fabrication and analysis of a body-caudal fin propulsion system for a microrobotic fish," *IEEE Int'l. Conf. Robotics and Automation*, (2008): 706-11.

Theses

-Stanford University, Department of Mechanical Engineering: PhD Thesis: "Applying Dry Adhesives to the Real World," 2015.

-Harvard University, School of Engineering and Applied Sciences: Mechanical Engineering Highest Honors Undergraduate Thesis: "Paradigm for Building Multi-functional Composite Structures with Embedded Actuation," 2009.

Patents

Granted:

1. T Susko, E Hawkes, E Sloan, MR Devlin "Variable Friction Shoe"- US Patent 12,082,641, 2024.

2. Okamura, A.M., Follmer, S., Hawkes, E.W., Hammond, Z., Usevitch, N.S., Schwager, M. and Ballard, J., Leland Stanford Junior University, 2023. *Reconfigurable, adaptable robotic structures*. U.S. Patent 11,794,334.

3. Hawkes, E. and Naclerio, N., 2023. *Soft robotic device with fluid emission for burrowing and cleaning*. U.S. Patent 11,633,849.

4. Hawkes, E.W., Camarillo, D., Suresh, S., Kurt, M., Fanton, M. and Cutkosky, M. "Constant Force impact protection device." US Patent No. 11632999. 2023.

5. Cutkosky, M., Han, K., Suresh, S., and Hawkes, E.W. "Glove with dry-adhesive and dry-non-adhesive micro-wedges." US Patent No. 11375762. 2022.

6. Hawkes, E.W., Okamura, A., Greer, J, and Blumenschein, L. "Robotic mobility and construction by growth." US Patent No. 10,954,789. 2020.

7. Hawkes, E.W., Christensen, D.L, and Cutkosky, M.R. "Air-bladder enhanced with gecko-adhesive for grasping applications." US Patent No. 10647004. 2020.

8. Hawkes, E.W., Jiang, H., and Cutksoky, M.R. "Surface grasping mechanism using directional adhesives," 2019. Patent No. 10,220,520.

9. Choi, I., Follmer, S. and Hawkes, E.W. "Wolverine: A wearable haptic interface for grasping in virtual reality," 2019. Patent No. 10,248,201.

10. Hawkes, E.W., Christensen, D.L, and Cutkosky, M.R. "Controllable Adhesive on Conformable Film for Non-flat surface," 2019. Patent No. 10,316,220.

11. Christensen, D.L, Hawkes, E.W., and Cutkosky, M.R. "Enhancing ground reaction forces beyond friction using dry adhesives," 2018. Patent No. 10,011,010.

12. Parness, A., Cutkosky, M.R., and Hawkes, E.W. "Grippers based on opposing van der Waals adhesive pads" 2014. Patent No. 9517610.

Grants

-US DoD CDMRP *A Biomimetic Tip-Growing, Self-Deploying Intubation Device for Safer, More Effective Airway Management in Austere, Far-Forward Environments,* $3.1M 09/2023-09/2026. PI

-The David and Lucile Packard Foundation, Packard Fellows: *Artificial Tip-growth as a New Paradigm for Minimally Invasive Patient Care,* $875k 11/1/20-10/31/2025

-NASA Early Career Faculty Award, Space Technology Research Grants: *Highly Mobile, Self-Anchoring Robots for Coordinated, High-Force Environmental Interaction,* $600k 10/1/2020-9/30/2023. PI

-NSF Faculty Early Career Development Program (CAREER) Award: *Physical Principles and Applications of Plant-Inspired Tip Growth for Robotics*, $600k 10/1/2020-9/30/2025. PI.

-NSF Emerging Frontiers Research Initiative: C3 SoRo: *Overcoming Challenges in Control of*

Continuum Soft Robots through Data-driven Dynamic Decomposition and Light-modulated Materials, $2m (among 5 PIs at UCSB), 10/1/19-9/30/24. Lead PI.

-NSF NRI: INT: COLLAB: *Mesh Of Robots on a Pneumatic Highway (MORPH): An Untethered, Human-Safe, Shape-Morphing Robotic Platform*, $1.5m ($450k PI share), 10/1/19 – 9/30/23. PI.

-NIH RO1: *VINE Catheter: Soft, Tip-extending, Robotic Catheters with Shape Control for Endovascular Surgery,* $1,427,259 direct, $2,147,984 estimated total ($450,000 PI share) 9/30/2022-9/29/2026. co-I.

-DoD CDMRP: "A Biomimetic Tip-Growing, Self-Deploying Intubation Device for Safer, More Effective Airway Management in Austere, Far-Forward Environments," $3,165,055 ($727,308 PI share) 9/15/2022-9/14/2026. Lead PI.

-Lockheed Martin: *Inspection with Vine Robots*, $100k, 1/1/19-2/31/20. Lead PI.

-NSF NRI: *Vine Robots: Achieving Locomotion and Construction by Growth*, $300k, via Stanford University, 07/01/2017-7/31/2020

-Honda Research: *Novel Variable Transmission Technology via Stanford University*, $150k, 11/1/2017-12/31/2020

-NSF Collaborative Research: *Root Dynamics and Control in Heterogeneous Soft Substrates*, $25k, 08/01/2019-07/31/2022

Teaching

-ME 153: Mechanical Design (required undergrad course). Complete re-design of course.

Perfect Student Evaluations from 2019: Course- 1.0, Instructor- 1.0

(scale from 1.0-Best to 5.0-Worst), 79 student respondents

-ME 225EH: Soft Robotics (Graduate). Built course from scratch. 1.1, 1.0 in from 2017 to 2019.

-ME 125EH: Soft Robotics (Undergraduate). Developed undergraduate version of above course to respond to demand. Course fills before regular enrollment opens.

Outreach

-Developed UCSB CSEP School of Scientific Thought Summer 5-week course for underrepresented high-school students in Santa Barbara County.
-With Santa Barbara's Museum of Exploration and Innovation, created exhibit to teach visitors how to build one of the root-inspired robots. Led multiple outreach events at the museum.
-Developed a bridge course for entering underrepresented freshman to expose them to research before beginning their Fall quarter. Grad student taught four 5-hour classes.
-Directed various lab tours, in which students come to visit the lab and explore the technology, as well as visits to schools, in which the technology is brought to the school.
-Shared course content for undergraduate/graduate Soft Robotics class with educators within California, in Indiana, and in New York (course based on research from lab).
-Shared course content for undergraduate Mechanical Design course with educators in South Korea (content based on jumping robot research).
--Science education video with "Veritasium" YouTube channel on world record jumping robots. Viewed over 11 million times.
-Science education video with "Veritasium" YouTube channel on vine-inspired robots. Viewed over 32 million times.

Presentations

-“Hard Questions for Soft Robotics,” IEEE Robosoft Conference, Keynote Talk, Virtual, 2021
-“Designing Non-linearity for Soft Robotics.” IEEE Robosoft Conference, Invited Workshop Speaker, 2021
-“Design of Soft Robots,” University of Bristol, Seminar, Bristol, United Kingdom, 2021
-“Medical Applications of Vine Robots,” IEEE AIM Conference, Invited Speaker, Boston, MA 2020
-“Vine Robots for Intubation,” Amazon MARS Conference, Invited Speaker, Ojai, CA, 2020 *postponed*
-“The Second Decade of Soft Robotics,” Gordon Research Conference, Ventura, CA. 2020
-“Soft Robotics and Science Robotics,” Invited talk to the editors of Science Robotics, Ventura, CA. 2020
-“Bio-inspired Robotics and Geotechnics,” Keynote Talk at the Bioinspired Geotechnics Workshop, Monterey, CA. 2019.
-“Bringing Soft to Robotics,” University of Minnesota. 2019
-“Soft Robotics,” Southern California Robotics Symposium. 2019
-“Bringing Soft Robotics to Surgery,” University of Washington, Seattle. 2018
-“Soft Robotics for Urology,” Museum of Natural History/ Santa Barbara, CA. 2018
-“Soft Robotics for Education,” MRL Teacher Workshop, UCSB. 2018
-“Vine-Inspired Soft Robotics,” 3rd Aslla Symposium/Seoul, South Korea
-“Tip-extending Robots for Medical Applications,” Medical Robotics Workshop, 2017 IEEE Int’l. Conf. Robotics and Automation.
-“Material Challenges for Soft Robotics,” Materials Research Lab IRG Meeting, UCSB, 2017.
-“Soft Robotics,” SCU Physics Colloquium 2016, Santa Clara University
-“Mechanics, Design, and Materials for Soft Robotics,” BiD Seminar 2016, UC Berkeley
-“Gecko Adhesion,” Exhibited work by invitation at TED2015, Vancouver, CA
-“Grasping without Squeezing,” ICRA 2015, Seattle, WA *Best Student Paper Award*
-“Climbing with 100x Body Weights,” ICRA 2015, Seattle, WA
-“Human Climbing with Gecko Adhesives,” ThinkTech Hawaii, 2014
-“Rock Climbing with Spines,” ARAVIS AG Venture Capital 2014, Stanford, CA
-“Dynamic Surface Grasping,” IROS 2013, Tokyo, Japan
-“Scaling Walls,” IROS 2011, San Francisco, CA
-“Adaptable,” EXPE 2010, Stanford, CA
-“Telepresentation,” SAP Headquarters 2009, Berlin, Germany
-“Microrobotic Swimmers,” Rhodes Scholar Presentation 2008, Birmingham, AL
-“Sample Holder for Quantum Chip Experiments,” REU Presentations 2007, Tallahassee, FL

Press for Research

Growing Robot

-Wall Street Journal: New Robot Mimics Vines
-San Francisco Chronicle: New Robot Grows like Vine to Reach Tight Places
-CBC News: Scientists Have Created a Robotic Tendril that Extends like a Vine
-Popular Science: Plant-inspired Robot Grows to Reach Difficult Places
-New Scientist: Bioinspired Robot Can Sneak Around Corners and Turn on Taps
-Discover Magazine: Top 100 of 2017- Tubular Technology
-Youtube, Veritasium Channel: "This plant-inspired robot could save your life."
Over 29 million views.

Jumping Robot

-Scientific American: Record-Breaking Jumping Robot Can Leap a 10-Story Building
-Newsweek: New Jumping Device Could Help Humans Spring Across Other Planets
-Inverse: Watch this robot jump the height of a ten-story building
-IEEE Spectrum: UCSB and Disney Find Out How High a Robot Can Possibly Jump
-Scientific American: Record-Breaking Jumping Robot Can Leap a 10-Story Building
-YouTube, Veritasium Channel: "World's Highest Jumping Robot." Over 7 million views, 4th in trending at release.

Perching MAV

-New York Times: *What You Get When You Blend a Drone and a Gecko*

Microrobots

-NBC News: *Tiny Gecko-Inspired Robots Carry Loads Over 100 Times Their Weight*
-Huffington Post: *Tiny Robots Use Gecko Power To Carry Heavy Weights*
-CNN Money: *These tiny robots have superhuman strength*
-Forbes: *These Micro Robots Can Haul 2,000 Times Their Weight*

Human Climbing Project

-Science Magazine News: *Gecko inspired adhesives allow people to climb walls*
-The Guardian: *Geckos inspire scientists in US military-developed SpiderMan project*
-Cell: *Building a Superhero*
-Newsweek: *Gecko gloves let scientist climb sheer glass walls*
-Popular Mechanics: *Scientists have created gecko-inspired spider man gloves*
-Stanford News: *Stanford engineers climb walls using gecko-inspired climbing device*
-Huffington Post: *Scientists Figure Out How To Scale Walls Like Spider-Man*
-Washington Post: *Inspired by geckos (and possibly 'Mission Impossible'), researchers unveil adhesives that allow humans to scale walls*
-BBC News: *Geckos inspire 'Spider-Man' gloves*
-Fox News: *Gecko-inspired adhesive enables people to scale buildings*

-MIT TechReview: *An Artificial Adhesive Outgrips the Gecko*

-Boston Globe: *A new invention that helps you climb like a gecko*

-San Jose Mercury News: (Front page in print) *Stanford 'lizard brains' create gecko-like paws that allow humans to scale glass walls*

-New York Times: *Climbing a Glass Building? Try a Gecko's Sticky Pads*

Personal

-Category 1 competitive cyclist with multiple podiums at National Championships
-Enjoy guitar, bonsai, yoga, hiking, and building gifts for loved ones