Dr. Elliot Wright Hawkes

Assistant 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 07/16-present
University of California, Santa Barbara
Assistant Professor

Collaborative Haptics And Robotics in Medicine Laboratory, 07/16-6/17
Stanford University, with Prof. Allison Okamura
Visiting Assistant Professor
-Led research and published on a growing robotics device
-Advised graduate students on PhD projects
-Designed and help run studies on a stroke rehab device

Collaborative Haptics And Robotics in Medicine Laboratory, 07/15-7/16
Stanford University, with Prof. Allison Okamura
Postdoctoral Scholar
-Studying soft robotic technologies to understand factors governing performance.
-Applied understanding to create a pneumatic artificial muscle capable of 400% strain.
-Studying robotic devices capable of growth.

Biomimetic and Dextrous Manipulation Laboratory, 12/09-06/15
Stanford University, with Prof. Mark Cutkosky
PhD Candidate

-Investigated the factors that determine the performance of gecko-inspired adhesives.
-Studied gecko adhesive morphology with custom sensor.
-Proposed two fundamental factors for performance: 1) Full Contact and 2) Even Loading.
-Demonstrated importance of factors by creating successful designs:
a) ankle mechanism for loading adhesives that increases capabilities seven-fold.
b) surface grasping mechanism that allows autonomous quadrotor perching.
c) adhesive device that shows little drop-off in performance even at human scale.
d) curved surface gripper for *grasping without squeezing.*
e) world's smallest climbing robot.
f) climbing robot capable of hoisting 100x body weight.
-Led team on multi-year project culminating in demonstration of first human to climb glass using hand-sized area of gecko adhesives.

Romotive, Inc. 1/12-3/13

Design Consultant
-Designed robust mechanism for holding and tilting iPhone for mobile robot.
-Mechanism requirements: 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
-Consulted on the 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
-Investigated the factors determining movement performance of a smart composite material with embedded actuation
-Demonstrated understanding with:
a) device capable of folding into 3D shapes
b) millimeter-scale multi-segmented robotic swimmer
-Optimized Shape Memory Alloy springs for use as artificial muscles.

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

Swiss Federal Institute of Technology, with Prof. Bradley Nelson

Herschel Smith Fellow
-Designed and fabricated actuated module for capsule-sized endoscopic microrobots as part of the Assembling Reconfigurable Endoluminal Surgical (ARES) system
-Established 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

-Designed, drafted (with CAD), and had machined an 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 the function and activation of the gluteus maximus in trunk stabilization during running and jumping, running test with EKG, force sensors and rate gyros.

Awards and Honors

-NSF Faculty Early Career Development Program (CAREER) Award 2020
-2019 Best Paper Award Finalist, Journal of Experimental Biology
-Mechanical Engineering Outstanding Faculty Award 2018-19
-IEEE Transactions on Robotics Best Paper Award for 2018
-AAAS Top Ten Robotics Technologies of the Year for 2018
-Top 100 Technologies of the Year, Discover Magazine, 2018
-IOP Publishing Outstanding Reviewer Award 2016
-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
-Co-author, Best Paper Award IEEE, IROS 2015
-Invited to exhibit work at TED2015
-Featured in Cosmos Magazine, Career Profile 2015
-Co-author 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
-Graduated with Highest Honors, Harvard School of Engineering and Applied Sciences, 2009
-Phi Beta Kappa, 2009
-Rhodes Scholarship Finalist, 2008
-Research Experience for Undergraduates recipient, Summer 2007- $3800
National Science Foundation

-Herschel Smith Undergraduate Research Program Award, Summer 2008- $6000

Herschel Smith Foundation, Harvard University

-First Place and new Harvard school record, Model Bridge Contest (5400lbs.), 2007

School of Engineering and Applied Sciences, Harvard University

-Harvard College Research Program Award, Summer 2007, Fall 2007, Fall 2008- $4800

Faculty of Arts and Sciences, Harvard University

Publications

Articles in Archival Journals

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

2. Greer, J. D., Blumenschein, L., Alterovitz, R., **Hawkes, E. W**., and Okamura, A. M., . Robust Navigation of a Soft Growing Robot by Exploiting Contact with the Environment. *International Journal of Robotic Research. 2020. In Press.*

3. Coad, M., Thomasson, R., Blumenschein, L., Usevitch, N., **Hawkes, E.W.**, and Okamura, A.O. *IEEE Robotics and Automation Letters.* (2020). *In Press.*
4. 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.**

5. 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.

6. 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).

7. 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.

8. 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.*

9. 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.

10. 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).

11. 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).

12. 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.

13. **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**.

14. 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.

15. **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.

16. 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.

17. 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).

18. **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.

19. 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).

20. 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).

21. **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).

22. **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).

23. 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).

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

25. 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.

26. 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.

27. **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.**

28. 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.

29. **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.

30. 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.

31. 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.

32. **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. **Over 400 Citations.**

33. 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 (in Review or Published)

34. 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. (Accepted.)*

35. 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. (Accepted.)*

36. 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.*

37. 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).

38. 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).

39. 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).

40. El-Hussieny, H., Mehmood, U., Mehdi, Z., Jeong, S.G., Usman, M., **Hawkes, E.W.,** Okarnura, 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).

41. 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.*

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

43. 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.*

44. 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.*

45. 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).

46. 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).

47. 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).

48. 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).

49. 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).

50. 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).

51. **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.*

52. 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.

53. 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.**

54. 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).

55. **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.**

56. **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).

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

58. 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).

59. 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.

60. 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.**

61. 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.

62. 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.

63. 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.

64. 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.

65. **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.

66. 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.

67. **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.

68. 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.

69. 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

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

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

3. 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.

4. Hawkes, E.W., Okamura, A.M. “Robotic mobility and construction by growth,” 2018. Patent Appl. No. 15/943329.

5. 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.

6. Hawkes, E.W., Eason, E.V., Christensen, D.L, and Cutkosky, M.R. “Climbing Device with Dry Adhesives,” 2015. PCT. Appl. No.: PCT/US2015/027729.

7. Hawkes, E.W., Christensen, D.L, and Cutkosky, M.R. “One Degree of Freedom Climbing Robot with Anisotropic Dry Adhesion,” 2015. U.S. Appl. No.: 14/926728.

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

Grants

Current and Pending

-NSF NRI: INT: COLLAB: Mesh Of Robots on a Pneumatic Highway (MORPH): An Untethered, Human-Safe, Shape-Morphing Robotic Platform, $1.5m ($400k PI share), 10/1/19 – 9/30/23

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

-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

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

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

-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

Previous (during PhD/postdoc)

-NASA “Astrobee,” $500,000, under Prof. Cutkosky, 2016

-Ford-Stanford Alliance “Gecko Gripper,” $250,000, PI: Prof. M. Cutkosky, 2015

-NSF NRI “Robosimian on Rough Terrain,” $1.5 million, PI: Prof. K. Hauser, 2015

-NASA JPL “CIF FY16 Advanced Concept,” $200,000, PI: Dr. A Parness, 2015

-DARPA “Z-Man,” Phase IIIb, $500,000, PI: Prof. M. Cutkosky, 2013

-NASA DRDF “ON-OFF Gecko Adhesion,” $200,000, PI: Dr. A. Parness, 2012

-DARPA “Programmable Matter,” Phase II, $1 million, PI: Prof. R. Wood, 2009

Teaching

-ME 153: Mechanical Design. Re-designed course. Evaluations from 2019: 1.0, 1.0.
-ME 225EH: Soft Robotics. Built course from scratch. 1.1, 1.0 in both 2017 and 2018.
-Guest lecturer for ME 161/261: Control, Vibration, Design of Dynamic Systems, Stanford, 2015
-Guest lecturer for ME 310: Design Innovation; Lecture on The Art of Iteration in Design, 2015
-Taught Stanford Cycling Safety and Skills Clinic, 2012-2015
-Mentored Stanford Undergraduate Research Institute Fellows, 2012-2015
-Mentored younger PhD students, resulting in 16 papers as co-author, 2012-2015
-Taught Stanford Cycling 301: Bicycle Fit, Maintenance, and Safety, 2014
-TA for both undergraduate and graduate levels, ME 161/261: Control, Vibration, and Design of Dynamic Systems, 2014
-Recognized as Outstanding TA by members of ME 161/261, 2014

Presentations

-“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 Colloquim 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
-“Climbing with 100x Body Weights,” ICRA 2015, Seattle, WA
-“Applying Gecko Adhesives,” PhD Defense 2015, Stanford, CA
-“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

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 Spider-Man suit 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 sponsored competitive cyclist with multiple podiums at National Championships
-Enjoy guitar, bonsai, yoga, hiking, and building gifts for loved ones