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Wyss Institute for Biologically Inspired Engineering
Harvard University
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EDUCATION

University of Pennsylvania School of Engineering and Applied Science, Philadelphia, PA

Ph.D. 2010 Mechanical Engineering

Dissertation: Passive Variable Compliance for Dynamic Legged Robots

Advisor: Mark Yim

Ad hoc committee: Daniel Koditschek, Vijay Kumar

M.S. 2006 Mechanical Engineering

B.S. 2004 Mechanical Engineering

ENGINEERING EXPERIENCE

Wyss Institute at Harvard University, Cambridge, MA

Research Engineer with the Advanced Technology Team

2010 - Present

Led original research as a technical lead or PI/co-PI in microrobotics, soft robotics, medical devices and assistive devices. Roles included student mentoring, needs finding, robotic and device design, field-testing, grant writing, forming and maintaining partnerships with clinical collaborators, IP development, and surveying opportunities to translate core technologies. Specific examples include:

- *Grip Glove* – Technical lead on a Wyss platform project focused on development of an assistive hand device for patients with severe hand weakness.
- *Deep Sea Soft Robotic Manipulator* – Technical lead on the development of soft robotic manipulators for deep sea exploration funded by the National Geographic Society.
- *Safety Drill* – Technical lead on the design and development of a 2nd generation cranial drill with passive drill bit retraction.
- PI on a DARPA seedling grant with Soft Robotics Inc. to develop biology-matched devices for medical applications (award no.: N66001-13-C-4036).
- Co-PI on ARL DURIP (award no.: W911NF-13-1-0311) for a new DPSS laser for rapid fabrication of monolithic high performance robots (FY 2013).
- Grant writing achievements include contributing key components to
 - DARPA Warrior Web proposal (Lead PI: Conor Walsh) (award no.: W911QX-12-C-0084).
 - National Robotics Initiative proposal, *Integrated modeling and manufacturing framework for soft fluidic robotics* (PI's: Conor Walsh, George Whitesides) (award no.: 1317744).

Lightning Packs LLC, Wayne, PA

Engineering Consultant

2009-2011

Explored methods to improve robustness and comfort of their patented suspended load backpack with specially designed compliant composite components.

Weiss Tech House, University of Pennsylvania, Philadelphia, PA

Advisor 2008-2010

Advised student-initiated projects on product development topics including brainstorming, team dynamics, prototyping, product development and intellectual property.

Traffic Safety Glove, Philadelphia, PA | 2007-2009

Founder 2007-2009

Invented and led development of a hand wearable illuminated traffic safety glove.

- Secured seed funding from Weiss Tech House (\$1k) and won the GAPSA-Provost Award for Interdisciplinary Research (\$6k) to build and test prototype as well as file IP.
- Led focus groups with the University of Pennsylvania Police Department to establish functional requirements, and ran small pilot study to collect early market feedback.

Sandbox Innovations LLC, Philadelphia, PA

Engineering Consultant summer 2008

Managed a small undergraduate engineering team to design, manufacture, and assemble mechanical hardware for 10 hexapedal running robots for a start-up company translating university technology.

Smart Motion Technologies LLC, Palo Alto, CA

Co-founder 2005-2008

Co-developed smart material actuators based on electroactive polymers.

- Surveyed technology opportunities within the prosthetics market and worked with a boutique law firm to develop an IP strategy.
- The novelty of this technology and business opportunity was recognized with first prize awards at the Wharton Business Plan competition, Fortune Small Business, and PennVention.

Redyns Medical LLC, Encino, CA

Engineering Consultant 2004-2005

Led early stage development of Prowick™, a commercially available post-arthroscopic medical wrap.

AWARDS & HONORS

- 2008 PennVention, *Traffic Safety Glove*, 2nd Place (\$2500)
- 2007 GAPSA-Provost Award for Interdisciplinary Innovation, *Traffic Safety Glove* (\$6k)
- 2007 PennVention, *Radiosonde Recovery*, Grand Prize (\$5k)
- 2006 Rang closing at the NASDAQ
- 2006 Wharton Business Plan Competition, *Smart Motion Technologies*, Grand Prize (\$20k)
- 2006 Fortune Small Business Battle of the Business Plans, *Smart Motion Technologies*, 1st place
- 2006 PennVention, *Smart Motion Technologies*, Grand Prize (\$5k)
- 2006 Penn Prize for Excellence in Teaching (\$500)
- 2006 ASME Student Design Competition, 3rd Place (\$400)
- 2004 Hugo Otto Wolf Memorial Prize, (\$200)

PUBLICATIONS

Journal Articles

- [J1] **K.C. Galloway**, K. Becker, B. Phillips, D. Tchernov, R. Wood, D. Gruber, “Soft Robotic Grippers for Biological Sampling on Deep Reefs.” *Soft Robotics Journal*. (under review)
- [J2] P. Polygerinos, Z. Wang, B. Overvelde, **K.C. Galloway**, R.J. Wood, K. Bertoldi, C.J. Walsh, 2015. “Modeling of Soft Fiber Reinforced Bending Actuators,” *IEEE Transactions on Robotics (T-RO)*, 31(3): 778-789, 2015.
- [J3] M.T. Tolley, R. Shepherd, B. Mosadegh, **K.C. Galloway**, M. Wehner, M. Karpelson, R. Wood, G. Whitesides, “A Resilient, Untethered Soft Robot.” *Soft Robotics*, 1(3):213-223, 2014.
- [J4] P. Polygerinos, Z. Wang, **K.C. Galloway**, R. Wood and C.J. Walsh, “Soft Robotic Glove for Combined Assistance and at-Home Rehabilitation.” *Robotics and Autonomous Systems (RAS) Special Issue on Wearable Robotics*, 73:135-143, 2014.
- [J5] R. Sahai, **K.C. Galloway**, R. Wood, “Elastic Element Integration for Improved Flapping-wing Micro Air Vehicle Performance.” *IEEE Transactions on Robotics (T-RO)*, 29(1):32-41, 2013.
- [J6] **K.C. Galloway**, J. Clark, D. Koditschek, “Variable Stiffness Legs for Robust, Efficient, and Stable Dynamic Running.” *Journal of Mechanisms and Robotics*, 5(1):011009, 2012.
- [J7] N. Perez-Arancibia, K. Ma, **K.C. Galloway**, R. Wood, “First Controlled Vertical Flight of a Biologically-Inspired Microrobot.” *Institute of Physics (IOP) Bioinspiration & Biomimetics*, 6(3): 036009, 2011.

Chapter

- [B1] **K.C. Galloway**, P. Polygerinos, R. Wood, C. Walsh, “Soft Robotic Glove for Combined Assistance and Rehabilitation During Activities of Daily Living.” *Encyclopedia of Medical Robotics*, Edited by Dr. Jaydev P. Desai, World Scientific Publishing Company. (under review)

Refereed Conference Articles

- [C1] P. Polygerinos, **K.C. Galloway**, S. Sanan, M. Herman, C. Walsh, “EMG Controlled Soft Robotic Glove for Assistance During Activities of Daily Living.” *International Conference on Robotics and Rehabilitation (ICORR)*, 2015. ***Best Paper Award***
- [C2] P. Polygerinos, **K.C. Galloway**, E. Savage, M. Herman, K. O’Donnell, C. Walsh, “Soft Robotic Glove for Hand Rehabilitation and Task Specific Training.” *IEEE International Conference on Robotics and Automation (ICRA)*, 2015.
- [C3] E.T. Roche, M.A. Horvath, A.A. Nodeh, **K.C. Galloway**, N.V. Vasilyev, D.J. Mooney, F.A. Pigula, C.J. Walsh “Design And Fabrication Of A Soft Robotic Direct Cardiac Compression Device.” *ASME International Design Engineering Technical Conferences (IDETC/CIE)*, 2015.
- [C4] M.T. Tolley, R. Shepherd, M. Karpelson, N. Bartlett, **K.C. Galloway**, M. Wehner, R. Nunes, G. Whitesides, R. Wood, “An Untethered Jumping Soft Robot,” *IEEE International Conference on Intelligent Robots and Systems (IROS)*, 2014.
- [C5] Y.L. Park, J. Santos, **K.C. Galloway**, E.C. Goldfield, R. Wood, “A Soft Wearable Robotic Device for Active Knee Motions through Development of Compact Flat Pneumatic Artificial Muscles,” *IEEE ICRA*, 2014.

- [C6] P. Maeder-York, T. Clites, E. Boggs, R. Neff, P. Polygerinos, D. Holland, L. Stirling, **K.C. Galloway**, C. Wee, and C. Walsh, "Biologically Inspired Soft Robot for Thumb Rehabilitation," *Journal of Medical Devices*, 8:020933, 2014.
- [C7] **K.C. Galloway**, P. Polygerinos, C. Walsh, R. Wood, "Mechanically Programmable Bend Radius for Fiber-Reinforced Soft Actuators." IEEE International Conference on Advanced Robotics (ICAR), 2013.
- [C8] R. Sahai, **K.C. Galloway**, M. Karpelson, R. Wood, "A Flapping-Wing Micro Air Vehicle with Interchangeable Parts for Optimization Studies." IEEE IROS, 2012.
- [C9] B. Finio, **K.C. Galloway**, R. Wood "A $\pm 140\mu\text{Nm}$ range, 5nNm resolution torque sensor for microrobotics applications." IEEE IROS, 2011.
- [C10] **K.C. Galloway**, J. Clark, M. Yim, D. Koditschek, "Experimental investigations into the role of passive variable compliant legs for dynamic robotic locomotion." IEEE ICRA, 2011.
- [C11] A. Yasemin, **K.C. Galloway**, Y. Yazicioglu, D. Koditschek, "Modeling the Compliance of a Variable Stiffness C-Shaped Leg Using Castigliano's Theorem," ASME IDETC/CIE, 2010.
- [C12] **K.C. Galloway**, R. Jois, M. Yim, "Factory Floor: A Robotically Reconfigurable Construction Platform," IEEE ICRA, Anchorage, AK, 2010.
- [C13] **K.C. Galloway**, J. Clark, D. Koditschek, "Design of a Tunable Stiffness Composite Leg for Dynamic Locomotion," ASME IDETC/CIE, San Diego, CA, 2009.
- [C14] **K.C. Galloway**, J. Clark, D. Koditschek, "Design of a Multi-Directional Variable Stiffness Leg for Dynamic Running," ASME International Mechanical Engineering Congress and Exposition (IMECE), 2007.
- [C15] S. Chitta, M. Karabas, **K.C. Galloway**, V. Kumar, "RoboTrikke: Design, Modeling, and Experimentation with a Robotic Trikke," ASME IDETC/CIE, 2006.

Patents

- [P1] E. Roche, W. Whyte, H. O'Neill, **K.C. Galloway**, D. Mooney, C. Walsh. *Delivery of therapy to living tissue*. Patent Pending.
- [P2] J. Lessing, G. Whitesides, Y. Shevchenko, R. Martinez, D. Yang, B. Mosadegh, **K.C. Galloway**, F. Guder, A. Tayi. *Sensors for soft robots and soft actuators*. Patent Pending.
- [P3] **K.C. Galloway**, J. Santos, R. Knopf, J. Lessing, J. Zakin, C. Vause. *Limb Stabilization Device*. International Patent Pending.
- [P4] **K.C. Galloway**, R. Knopf, J. Lessing. *Rigidizing Inflatable Structures*. International Patent Pending, application PCT/US15/26091.
- [P5] **K.C. Galloway**, J. Lessing. *Soft Retractors*. International Patent Pending, application PCT/US15/36281.
- [P6] **K.C. Galloway**. *Manufacturing Soft Devices from Sheet Materials*. International Patent Pending, application PCT/US2014/058244.
- [P7] **K.C. Galloway**. *Mechanically Programmed Soft Actuators with Conforming Sleeves*. International Patent Pending, application PCT/US2014/060870.
- [P8] **K.C. Galloway**, C. Walsh, D. Holland, P. Polygerinos, T. Clites, C. Maeder-York, R. Neff, E. Boggs, Z. Dubrovsky. *Multi-segment Reinforced Actuators and Wearable Applications*. International Patent Pending, application PCT/US2014/062844.

- [P9] K. Xiao, P. Loschak, **K.C. Galloway**, H. Pei, S. Kesner, A. Thomas, C. Walsh. *Methods and Devices for Safely Penetrating Materials*. International Patent Pending, application PCT/US2012/052470.
- [P10] **K.C. Galloway**, J. Clark, D. Koditschek. *Variable Stiffness Leg Structure for Multipede Running Robots*. U.S. Patent 8,789,630. Awarded: Jul. 29, 2014.
- [P11] I. Alvarez, S. Alvarez, **K.C. Galloway**, H. Katzenberg, R. Kothari, J. Arthur. *Dielectric elastomer fiber transducers*. U.S. Patent 7,834,527. Awarded: Nov. 16, 2010.