

Ben Goldberg, PhD

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EDUCATION	Ph.D., Engineering Sciences Harvard University	July 2017
	M.S., Engineering Sciences Harvard University	May 2014
	B.S., Mechanical Engineering Johns Hopkins University	May 2012
POSITIONS HELD	Ph.D. Candidate and NSF Research Fellow Harvard University Microrobotics Lab Advisor: Prof. Rob Wood	2012 - 2017
	Teaching Assistant Introduction to Robotics (Industrial Robot Arm Path Planning)	2014
	Research Assistant Johns Hopkins University Applied Physics Lab Advisor: Jeff Barton and Jon Castelli	2009-2011
	Manufacturing Engineering Intern Jacobs Vehicle Systems Advisor: Samuel Fabian and John Rose	2010
AWARDS AND HONORS	NSF Graduate Research Fellow (NSF/GRFP)	2014-2017
	NDSEG Graduate Research Fellowship	2014
	William N. Sharpe, Jr. Award for Student Involvement	2012
	Undergraduate Deans List and Various Academic Awards	2008 - 2012
RELEVANT GRADUATE COURSEWORK	Mechatronics, Introduction to Robotics, Robot Sensors and Actuators, Medical Device Design, Computer Vision, Advanced Topics in Robotics, Advanced Scientific Computing ,Dynamics of Robots and Spacecraft	
COMMITTEES	Harvard Environmental Health and Safety	2015-Present
	Harvard Sustainability and Green Lab Initiatives	2016-Present

SKILLS & PROFICIENCIES	Project Management, Electronic Circuit Design, Microfabrication, High Speed Videography, Photolithography, Rapid Prototyping, Welding, Machining, Computer Aided Design, Computer Vision, Machine Learning, Embedded Programming, Microcontrollers	
SOFTWARE	MATLAB, Solidworks, COMSOL, Pro/Engineer, AutoCAD, LaTeX, and more	
TEACHING EXPERIENCE	Introduction to Robotics	Fall 2014
	Teaching fellow for Engineering Sciences 159/259: Introduction to Robotics taught by Professor Rob Wood. Teach lab sections with industrial robot arm.	
RESEARCH EXPERIENCE	Design of an Electromagnetic Voice Coil Actuator	2012-2017
	Harvard Microrobotics Lab Develop a new design for a voice coil actuator (VCA) that can be used in millimeter-scale devices. Pop-up manufacturing processes and laser micromachining are used to fabricate the devices. Patent pending.	
	The Harvard Ambulatory MicroRobot	2012-2017
	Harvard Microrobotics Lab Work on the design and characterization of a 1.5g micro robot that can be used for confined space exploration and search and rescue. All manufacturing is done in house with carbon fiber and piezoelectric elements. Microcontroller programming enables autonomous operation. High speed camera and sensor measurements used to confirm dynamic modeling of the complete system.	
	Ad-Hoc Networking in Unmanned Autonomous Systems	2009-2011
	Johns Hopkins University Applied Physics Lab Create a system of six, meter-scale unmanned aerial vehicles (UAV's) that interface through a mobile, ad-hoc (decentralized and adaptive) wireless network to share intelligence, surveillance, and reconnaissance (ISR) data with other unmanned agents. Demonstration in July 2011 integrated one of the 6 unmanned planes assembled and prepared by myself with the Boeing ScanEagle UAV. See Boeing Press Release .	
INDUSTRY EXPERIENCE	Detroit Diesel Engine Brake Manufacturing	Summer 2010
	Jacobs Vehicle Systems Lead the data collection and analysis for overall equipment effectiveness (OEE) in exhaust rocker machining cells for the Detroit Diesel DD-15 engine brake. Introduce automated assembly line for increase in speed and quality of assembly.	

EXTRACURRICULAR
EXPERIENCE

Design, Build, Fly Student Design Competition

2010-2012

Johns Hopkins University

Leadership Roles: Co-Founder & Team Captain

Recipient of Student Initiatives Fund and team captain for Design, Build, Fly competition team where group of students design, build, and fly a remote controlled plane to carry out 3 different missions that change each year. Team uses both computer modeling software and wind tunnel testing in the design process.

FIRST Robotics

2004-2012

Treasurer, vice president, and robot operator over four years on Team 1124 in the high school robotics design competition. Team won 3 regional competition titles and was a finalist at the international competition in 2008. From 2008-2012, mentored Team 2534 for four successful seasons.

Mechanical Engineering Student Council Representative

2008-2012

Johns Hopkins University

Serve as the Class of 2012 representative for the Mechanical Engineering Department. Act as liaison between student and faculty members. Discuss strengths and areas of improvement for the department and put on social events for the department.

MENTORSHIP

Masters Student Advisor (2012-2017)

Benedikt Seitz – Adhesion mechanisms and climbing for microrobots.

Remo Brühwiler – Optical mouse sensors for position estimation in a legged microrobot.

Raphael Zufferey – Wireless communication integration in a legged microrobot.

Sebastien de Rivaz – Electroadhesion for climbing microrobots

Maxime Roy – RF antenna for an autonomous microrobot

Undergraduate Student Advisor (2012-2017)

Carter Ithier – Leg compliance in an ambulatory microrobot.

Ayotunde Demuren – Design and operation of a treadmill for ambulatory microrobots

Jack Zhou – Design of a passive alignment ankle for ambulatory microrobots.

Yankang Yang – The effect of posture on the performance of a cockroach inspired microrobot.

Lyra Wanzer – Design of a tail mechanism for a cockroach inspired microrobot.

PUBLICATIONS

Patents

- [P1] Z. Dubrovsky, J. Gafford, **B. Goldberg**, M. Karpelson, S.B. Kesner, K. O'Donnell, M.J. Smith, C.J. Walsh and R.J. Wood. *Pop-Up Laminate Structures with Integrated Electronics*. U.S. Patent Application No. 14/909,792, filed August 2014. Patent Pending – [Link](#).

Peer-Reviewed Journal Publications

- [J3] **B. Goldberg**, N. Doshi, K. Jayaram, and R.J. Wood, *Gait studies for a quadrupedal microrobot reveal contrasting running templates in two frequency regimes*. Bioinspiration and Biomimetics – [Link](#). May 2017.
- [J2] D.M. Aukes, **B. Goldberg**, M.R. Cutkosky, and R.J. Wood, *An analytic framework for developing inherently-manufacturable pop-up laminate devices*. Smart Materials and Structures – [Link](#). August 2014.
- [J1] A.T. Baisch, O. Ozcan, **B. Goldberg**, D. Ithier, and R.J. Wood, *High speed locomotion for a quadrupedal microrobot*. The International Journal of Robotics Research – [Link](#). May 2014.

Peer-Reviewed Conference Publications

- [C10] **B. Goldberg**, N. Doshi, Kaushik Jayaram, Je-Sung Koh, and R. J. Wood. *A high speed motion capture method and performance metrics for studying gaits on an insect-scale legged robot*. International Conference on Intelligent Robots and Systems (IROS), Vancouver, Canada, To Appear: September, 2017.
- [C9] **B. Goldberg**, N. Doshi, R. J. Wood. *High speed trajectory control using an experimental maneuverability model for an insect-scale legged robot*. International Conference on Robotics and Automation (ICRA), Singapore, June, 2017 - [Link](#).
- [C8] N. Doshi, K. Jayaram, **B. Goldberg**, and R. J. Wood. *Phase control for microrobots running near resonance*. International Conference on Robotics and Automation (ICRA), Singapore, June, 2017.
- [C7] R. Bruhwiler, **B. Goldberg**, N. Doshi, O. Ozcan, N. Jafferis, M. Karpelson, R. J. Wood. *Feedback Control of a Legged Microrobot with On-Board Sensing*. International Conference on Intelligent Robots and Systems (IROS), Hamburg, Germany, Sept. 2015 – [Link](#).
- [C6] N. Doshi, **B. Goldberg**, R. Sahai, N. Jafferis, D. Aukes, R. J. Wood. *Model Driven Design for Flexure-Based Microrobots*. International Conference on Intelligent Robots and Systems (IROS), Hamburg, Germany, Sept. 2015 – [Link](#).
- [C5] B. Seitz, **B. Goldberg**, N. Doshi, O. Ozcan, D. Christensen, E. Hawkes, M. Cutkosky, and R. J. Wood. *Bio-inspired mechanisms for inclined locomotion in a legged insect-scale robot*. IEEE International Conference on Robotics and Biomimetics, Bali, Indonesia. December, 2014 – [Link](#).
- [C4] B. Googe, **B. Goldberg**, R. Jordan. *Design of Novel Malar Implant with Dual Plane Adhesion*. ASME Design of Medical Devices, Minneapolis, MN, April, 2015 – [Link](#).

- [C3] **B. Goldberg**, M. Karpelson, O. Ozcan, and R.J. Wood, *Planar Fabrication of a Mesoscale Voice Coil Actuator*. IEEE Int. Conf. on Robotics and Automation, Hong Kong, China, May, 2014 – [Link](#).
- [C2] M. Karpelson, B. Waters, **B. Goldberg**, B. Mahoney, O. Ozcan, A. Baisch, P.M. Meyitang, J. R. Smith, R. J. Wood, *A Wirelessly Powered, Biologically Inspired Ambulatory Microrobot*. IEEE Int. Conf. on Robotics and Automation, Hong Kong, China, May, 2014 – [Link](#).
- [C1] A. Degirmenci, **B. Goldberg**, L. Bielskis, S. Wiggins, P. Polygerinos, Donal Holland, S. Dyer, and C. Walsh, *Cervical Spine Immobilization Device for Emergency Response*. ASME Design of Medical Devices, Minneapolis, MN, April, 2014 – [Link](#).