

Benjamin I. Goldberg

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EDUCATION	Ph.D., Engineering Sciences Harvard University	November 2017
	M.S., Engineering Sciences Harvard University	May 2014
	B.S., Mechanical Engineering Johns Hopkins University	May 2012
POSITIONS HELD	Post-doctoral Researcher Harvard University Microrobotics Lab Advisor: Professor Robert J. Wood	2017-Present
	PhD Candidate Harvard University Microrobotics Lab Dissertation: <i>Gait studies for a power and control autonomous legged microrobot</i> Advisor: Professor Robert J. 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	Solid modeling, 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	The Harvard Ambulatory MicroRobot	2013-2017
	Harvard Microrobotics Lab	
	<i>Leadership roles:</i> Project manager, mentor 4 master student theses	
	Design, test, and characterize 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. Leveraged machine learning techniques (policy search) for discovering new, high speed quadrupedal gaits. Microcontroller programming enables autonomous operation. High speed camera and sensor measurements used to confirm dynamic modeling of the complete system.	
	Design of an Electromagnetic Voice Coil Actuator	2012-2015
	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.	
	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	<p>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.</p>
EXTRACURRICULAR EXPERIENCE	<p>Design, Build, Fly Student Design Competition 2010-2012 Johns Hopkins University <i>Leadership Roles:</i> 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.</p> <p>FIRST Robotics Mentor 2008-2012 Lead mechanical engineering mentor for high school FIRST robotics team (team 2534).</p> <p>Mechanical Engineering Student Council Representative 2008-2012 Johns Hopkins University Serve as the Class of 2012 representative for the Mechanical Engineering Department and liaison between student and faculty members. Discuss strategies and areas of improvement for the department and put on social events for the department.</p>
MENTORSHIP	<p>Masters Student Advisor (2012-2017) Benedikt Seitz – Adhesion mechanisms and climbing for microrobots. Remo Brühwiler – Optical mouse sensors for “pose” 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</p> <p>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 legged microrobot. Lyra Wanzer – Design of a tail mechanism for a cockroach inspired microrobot.</p>

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, September, 2017. ***Best Paper Nominee**
- [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](#).