

Robin L. H. Deits

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EDUCATION **Massachusetts Institute of Technology: Ph.D. Candidate** **Sept. 2012 to Present**
Department of Electrical Engineering & Computer Science, Robot Locomotion Group.

MIT: Master of Science, EE&CS **Sept. 2014. GPA: 5.0/5.0**
Developed a novel algorithm to segment an environment into convex regions to allow global optimization and applied it to bipedal footstep planning.

MIT: Bachelor of Science, Physics **June 2011. GPA: 4.9/5.0**

HONORS **Hertz Foundation Graduate Fellowship** **2011**
MIT-Schlumberger Energy Initiative Fellowship **2012**
MIT Prince Edward Fellowship **2012**
Phi Beta Kappa Honors Society, Xi Chapter **2011**
Sigma Pi Sigma Physics Honors Society **2011**

EXPERIENCE **Robot Locomotion Group**

Ph.D. Candidate Researcher **September 2012 to Present**

Researching motion planning for walking robots:

- Developed the footstep planning software used by Team MIT in the DARPA Robotics Challenge Virtual Robotics Challenge and Robotics Challenge Trials [6]
- Currently developing new techniques to allow global optimization of walking and flying robot motions through mixed-integer convex programming [2, 3]

Engineering Consulting

Subcontracted by Battelle Memorial Institute **September 2011 to August 2012**

Consulted on a variety of interdisciplinary projects:

- Developed a software system for tracking the digging movements of a live razor clam for the MIT RoboClam project
- Produced a software package for gait control for a novel walking robot
- Conducted experiments and analyzed data to develop a natural language system for human-robot interaction [7, 9]

MIT, Department of EECS, Lab For Electromagnetic and Electronic Systems

Power Electronics and Microcomputer Lab Assistant **September 2010 to May 2011**

Assisted in teaching the laboratory component of 6.115: Microcomputer Project Lab and 6.131: Power Electronics Lab. Gained expertise designing and debugging systems ranging from power electronics to C and assembly code.

Undergraduate Researcher **November 2010 to February 2011**

Developed an HTML and JavaScript interface for interacting with data from the NILM power consumption management system.

MIT, Department of Mechanical Engineering, Hatsopolous Microfluids Lab

Undergraduate Researcher **January 2009 to December 2010**

Worked on the MIT RoboClam project sponsored by Bluefin Robotics and Battelle to design an efficient, biologically inspired burrowing mechanism

- Designed and wrote a genetic algorithm to optimize the robot's control parameters [14]
- Wrote control and data acquisition software for the robot
- Performed analysis of the efficiency and energy consumption of the system [8]
- Ran tests of the robot in the lab and in the field

Siemens Dynamowerk, Berlin, Germany

Intern

June to August 2010

Implemented an optimization system in MATLAB and achieved significant improvements in expected efficiency of magnetic bearing systems. Work resulted in a patent, granted in June 2012 [11, 5].

Mazemakers, Wellesley, MA

Senior Counselor

June to August 2008 & 2009

Designed and taught lessons on a variety of subjects, including Robotics, Video Game Design, and Science.

- Introduced children as young as 8 to basic concepts of programming and engineering
- Developed course plans, activities, and demonstrations for science, photography, game design, art, and robotics classes.

SKILLS

Computer Science:

- Controls, data analysis, and optimization in MATLAB, Python, and LABVIEW
- Additional programming experience in C, C++, Intel 8051 assembly, Java, HTML, CSS, JavaScript, Julia, and Go
- Hardware and FPGA design with BlueSpec
- Data acquisition using National Instruments DAQ hardware and software
- Design and implementation of genetic algorithms and neural networks
- Software including Windows/MacOS/Linux, MS Office, L^AT_EX, Eclipse, Vim

Electrical Engineering:

- Power electronics circuits, including buck/boost converters, transformers, and rectifiers.
- Analog and digital electronic systems, including Intel, Pic, and Atmel microcontrollers

Mechanical Engineering:

- Mechanical design using Solidworks CAD software
- Machine tools including the lathe, milling machine, and CNC mill

PROJECTS

Adaptive Particle Image Velocimetry

- Implemented a recent approach to fluid flow tracking on an FPGA: http://csg.csail.mit.edu/6.375/6_375_2013_www/handouts/finals/group2_report.pdf

Cryptic Crossword Solver

- Applied techniques from linguistics and natural language processing to solving cryptic crossword clues: <http://blog.robindeits.com/2013/02/11/a-cryptic-crossword-clue-solver/>

PUBLICATIONS

- [1] R. Deits, "Convex segmentation and mixed-integer footstep planning for a walking robot," Science master's thesis, Massachusetts Institute of Technology, Cambridge, MA, Sep. 2014. [Online]. Available: http://groups.csail.mit.edu/robotics-center/public_papers/Deits14b.pdf
- [2] R. Deits and R. Tedrake, "Footstep planning on uneven terrain with mixed-integer convex optimization," *IEEE-RAS International Conference on Humanoid Robots*, Nov. 2014. [Online]. Available: http://groups.csail.mit.edu/robotics-center/public_papers/Deits14a.pdf
- [3] —, "Computing large convex regions of obstacle-free space through semidefinite programming," in *Workshop on the Algorithmic Foundations of Robotics*, Istanbul, Turkey, 2014. [Online]. Available: http://groups.csail.mit.edu/robotics-center/public_papers/Deits14.pdf
- [4] A. G. Winter, V. R. L. H. Deits, D. S. Dorsch, A. H. Slocum, and A. E. Hosoi, "Razor clam to RoboClam: burrowing drag reduction mechanisms and their robotic adaptation," *Bioinspiration & Biomimetics*, vol. 9, no. 3, p. 036009, Sep. 2014. [Online]. Available: <http://iopscience.iop.org/1748-3190/9/3/036009>

- [5] R. Deits and M. Lang, “Radial magnetic bearing for magnetic support of a rotor,” Patent Application US 2013/0 293 051 A1, 2014. [Online]. Available: <http://www.freepatentsonline.com/20130293051.pdf>
- [6] M. Fallon, S. Kuindersma, S. Karumanchi, M. Antone, T. Schneider, H. Dai, C. Perez D’Arpino, R. Deits, M. DiCicco, D. Fourie, T. Koolen, P. Marion, M. Posa, A. Valenzuela, K.-T. Yu, J. Shah, K. Iagnemma, R. Tedrake, and S. Teller, “An architecture for online affordance-based perception and whole-body planning,” *Journal of Field Robotics*, 2014. [Online]. Available: <http://dspace.mit.edu/handle/1721.1/85690>
- [7] R. Deits, S. Tellex, P. Thaker, D. Simeonov, T. Kollar, and N. Roy, “Clarifying commands with information-theoretic human-robot dialog,” *Journal of Human-Robot Interaction*, vol. 2, no. 2, pp. 58–79, 2013. [Online]. Available: <http://humanrobotinteraction.org/journal/index.php/HRI/article/view/112>
- [8] A. G. Winter, R. L. H. Deits, and D. S. Dorsch, “Critical timescales for burrowing in undersea substrates via localized fluidization, demonstrated by RoboClam: a robot inspired by atlantic razor clams,” in *ASME 2013 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference*, 2013. [Online]. Available: http://gear.mit.edu/Publications/RoboClam/2013_RoboClam_ASME_IDETC_Final.pdf
- [9] S. Tellex, P. Thaker, R. Deits, D. Simeonov, T. Kollar, and N. Roy, “Toward information theoretic human-robot dialog,” in *Robotics: Science and Systems Conference*, 2012. [Online]. Available: <http://www.roboticsproceedings.org/rss08/p52.pdf>
- [10] A. G. Winter, R. L. H. Deits, and A. E. Hosoi, “Localized fluidization burrowing mechanics of ensis directus,” *Journal of Experimental Biology*, vol. 215, no. 12, pp. 2072–2080, 2012. [Online]. Available: <http://jeb.biologists.org/cgi/doi/10.1242/jeb.058172>
- [11] M. Lang and R. Deits, “Radial magnetic bearing for the magnetic bearing of a rotor,” Patent, 2012. [Online]. Available: <http://patentscope.wipo.int/search/en/WO2012084590>
- [12] A. G. Winter, R. L. H. Deits, D. S. Dorsch, and A. E. Hosoi, “Multi-substrate burrowing performance and constitutive modeling of RoboClam: A biomimetic robot based on razor clams,” in *ASME 2010 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference*, 2010. [Online]. Available: <http://ieeexplore.ieee.org/lpdocs/epic03/wrapper.htm?arnumber=5654364>
- [13] A. G. Winter, R. Deits, D. S. Dorsch, A. E. Hosoi, and A. H. Slocum, “Teaching RoboClam to dig: The design, testing, and genetic algorithm optimization of a biomimetic robot,” in *International Conference on Intelligent Robots and Systems (IROS), 2010 IEEE/RSJ. IEEE*, 2010, pp. 4231–4235. [Online]. Available: http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=5654364
- [14] A. G. Winter, A. E. Hosoi, A. H. Slocum, and R. L. H. Deits, “The design and testing of RoboClam: A machine used to investigate and optimize razor clam-inspired burrowing mechanisms for engineering applications,” in *ASME 2009 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference IDETC/CIE 2009*, 2009, pp. 1–6.