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EDUCATION

- Ph.D. **Cornell University**
Mechanical Engineering, *expected graduation May 2013*
- M.S. **Cornell University**
Mechanical Engineering, *2012*
- B.S. **University at Buffalo, The State University of New York**
Mechanical Engineering, *Summa Cum Laude 2008*
- Study Abroad **Universite de Technologie de Troyes, France**
Summer 2005

PROFESSIONAL EXPERIENCE

- 1/09 – present **Creative Machines Lab, Cornell University**
(One of PopSci's 25 Most Awesome College Labs 2011)
Graduate Research Assistant, Advisor: Prof. Dr. Hod Lipson
- 9/07 – 5/08 **Automation Robotics & Mechatronics Laboratory, University at Buffalo**
Undergraduate Researcher, Advisor: Prof. Dr. Venkat Krovi
- 5/07 – 5/08 **Design of Open Engineering Systems Laboratory, University at Buffalo**
Undergraduate Researcher, Advisor: Prof. Dr. Kemper Lewis
- 5/06 – 8/06 **Fisher-Price Brands, East Aurora, New York**
Mechanical Engineering Intern, Infant Toys Group

RESEARCH EXPERIENCE



2009-present

Universal Robotic Gripping

Creative Machines Lab, Cornell

With colleagues from the University of Chicago and iRobot®, I designed and built the "Universal Jamming Gripper" that was featured on the cover of the Proceedings of the National Academy of Sciences (PNAS) in November 2010. This gripper exploits the jamming phase transition of granular materials as the gripping mechanism. Consisting of a mass of granular material encased in an elastic membrane, the gripper passively conforms to the target object, then vacuum-hardens to generate a gripping force. This approach proves to be simple, low cost, and well suited for a wide range of gripping tasks. Improvements on the original design, including the added ability to "shoot" gripped objects by fast inflation of the gripper were published in the IEEE Transactions on Robotics (TRO). Current goals include the achievement of more complicated manipulation tasks with jamming grippers.



2008-present

Controlled Granular Jamming

Creative Machines Lab, Cornell

I am currently studying the phase transition jamming phenomenon of granular materials, with a focus on applications for programmable matter. Jamming is a unique property of granular materials that allows them to undergo a fluid-like to solid-like phase transition without a change in temperature. When grains are loosely combined, they yield under shear stress (like a fluid); if they are packed together, they jam in position and resist applied stresses (like a solid). The term programmable matter describes some not-yet-achieved form of matter that would have the ability to transition from its current shape into any desired shape – reversibly, on command, and under its own power.

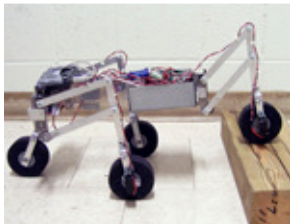


2011

Open Source Material Testing Machine

Creative Machines Lab, Cornell

Universal testing machines (like those sold by Instron®, Tinius Olsen, MTS Systems, and others) are poorly suited for a parallelized testing approach due to their size and cost. As a solution to this problem we designed a low cost, desktop size, open source, universal testing machine that we call freeLoader (shown at left). Each freeLoader can perform two simultaneous material tests, at loads up to 5 kN with ± 1.8 N accuracy, and at speeds ranging from 2 mm/min to 30 mm/min. Five freeLoader machines can be built for the same cost as one commercial machine – yielding a tenfold increase in testing throughput. The freeLoader was first published at the 2011 ASME IDETC/CIE Mechanisms and Robotics Conference. More information (including parts lists, build instructions, a user manual, and control software) can be found at creativemachines.cornell.edu/freeloader.



2007-2008

Leg-wheeled Robotic Locomotion

ARM Lab, University at Buffalo

A leg-wheeled robot locomotes using wheels that are connected to the chassis through a leg-like suspension system. As part of an NSF Research Experience for Undergraduates (REU), I designed and built such a robot (shown at left) based on a specific mechanism that combined four-bar linkages and torsion springs in order to maximize the range of motion of the suspension while minimizing its degrees of freedom. The goal was to develop a robot that showed improved performance in rough or hazardous terrain over robots with more conventional suspension systems.

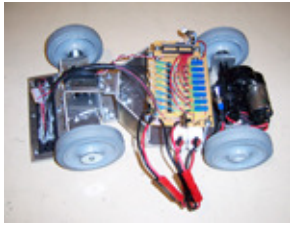


2007-2008

Autonomous Vehicle Design

UB Robotics, University at Buffalo

I helped lead the University at Buffalo Robotics Club in the design and construction of an autonomous robot for the 2008 Intelligent Ground Vehicle Competition (IGVC). This competition requires participants to solve open-ended sensing, estimation, control, and locomotion problems, in order to produce a vehicle that can navigate autonomously, subject to the constraints of its operating environment. We placed tenth out of 41 teams at the competition with the vehicle shown here. The vehicle sported a custom-built skid-steer drive train and utilized electric ATV components. It also featured a digital compass, laser range finder, video camera, and differential GPS.

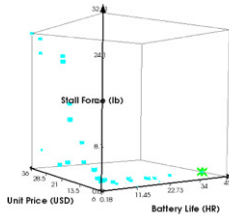


2007-2008

Consumer Robotics Design

DOES Lab, University at Buffalo

Consumer Robotics is still a field for which the product design and development process is not very mature. I studied consumer robotics development from a product platforming perspective using a wheeled companion robot as a case study. To analyze the potential market I hosted an online survey which was taken by over 200 potential customers. The robot shown here was designed, built, and tested as part of the project.



2008

Multiobjective Visualization

DOES Lab, University at Buffalo

It is difficult for humans to gain any valuable insight from data that is displayed in more than the usual three spatial dimensions. There are software programs designed specifically for this type of problem, but most were developed for very specific types of data, and few are widely marketed. My research in multiobjective visualization was in the development of a method for reviewing, comparing, and cataloging available software programs. We aimed to connect research communities by revealing novel uses for preexisting software tools in order to promote multidisciplinary breakthroughs. I presented my results at the 2008 AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference.



2007

Green Engineering

DOES Lab, University at Buffalo

I received a Zimmer Research Scholar Award to study green engineering and the adoption of green practices in the mechanical engineering design process. My research focused on motivations and strategies for implementing environmentally conscious design and manufacturing practices. I was awarded travel grants to present my research at both the 2007 ASME IDETC/CIE Conference and the 2008 NSF CMMI Engineering Research and Innovation Conference.

JOURNAL PUBLICATIONS

Amend, J.R., Jr., Brown, E., Rodenberg, N., Jaeger, H.M., Lipson, H., "A positive pressure universal gripper based on the jamming of granular material," *IEEE Transactions on Robotics*, to appear.

Brown, E., Rodenberg, N., Amend, J., Mozeika, A., Steltz, E., Zakin, M.R., Lipson, H., Jaeger, H.M., "Universal robotic gripper based on the jamming of granular material," *Proceedings of the National Academy of Sciences* (cover article), vol. 107, no. 44, pp. 18809-18814, 2010.

CONFERENCE PROCEEDINGS

Jiang, Y., Amend, J.R., Jr., Lipson, H., and Saxena, A., "Learning hardware agnostic grasps for a universal jamming gripper," *IEEE International Conference on Robotics and Automation (ICRA)*, St. Paul, MN, 2012, to appear.

Amend, J.R., Jr., and Lipson, H., "freeLoader: an open source universal testing machine for high-throughput experimentation," *ASME IDETC/CIE Conference*, Washington, DC, 2011.

Amend, J.R., Jr., and Lipson, H., "Shape-Shifting Materials for Programmable Structures," *Proceedings of the 11th International Conference on Ubiquitous Computing: Workshop on Architectural Robotics*, Orlando, FL, 2009.

Amend, J.R., Jr., "A Critical Review of Software Tools for Multidimensional Visualization and Related Applications," *12th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference Student Paper Competition*, Victoria, BC, Canada, 2008.

POSTER PRESENTATIONS AND CONTRIBUTED TALKS

Amend, J.R., Jr., and Lipson, H., "A Universal Robotic Hand for Gripping and Releasing," *Cornell Center for Technology Enterprise and Commercialization (CCTEC) New Business & Emerging Technology Showcase*, Ithaca, NY, 2011.

Amend, J.R., Jr., "A Universal Robotic Gripper Based on Jamming Phenomena," *Cornell Engineering Research Conference (CERC)*, Ithaca, NY, 2010 (Best presentation in computational modeling and robotics).

Amend, J.R., Jr., and Lipson, H., "Jamming Granular Materials for Physically Adaptive Robots," *Sibley Graduate Research Conference (ReCon)*, Ithaca, NY, 2010 (Best poster award).

Amend, J.R., Jr., and Lipson, H., "Universal Gripping 'Hand' for Robots" *Cornell Center for Technology Enterprise and Commercialization (CCTEC) New Business & Emerging Technology Showcase*, Ithaca, NY, 2010.

Amend, J.R., Jr., "Green Engineering: Design Engineering for a Brighter Future," *NSF CMMI Engineering Research and Innovation Conference - Poster Presentation*, Knoxville, TN, 2008.

Amend, J.R., Jr., "Green Engineering: Design Engineering for a Brighter Future," *ASME IDETC/CIE Conference - Student Paper and Poster Presentation*, Las Vegas, NV, 2007.

INVITED TALKS

A Universal Granular Gripper. *Cornell Dynamics, Systems and Control Seminar Series*, Ithaca, NY, November 17, 2009.

PATENTS

US Patent Application WO/2011/130475, Gripping and Releasing Apparatus and Methods.

RECOGNITION IN POPULAR PRESS

My work has been covered a number of different news outlets including:

Nature News, Popular Science, Scientific American, Science Magazine, NewScientist, MIT Technology Review, Wired, The Washington Post, IEEE Spectrum, Gizmodo, Reuters, MSNBC, Discovery Channel News, Discover Magazine, Chemical & Engineering News, Popular Mechanics, The Wall Street Journal, AUVSI Unmanned Systems Magazine, Make Magazine, Servo Magazine, and Seed Magazine.

A more complete list (over 170 different sources at last count) including links can be found at: <http://creativemachines.cornell.edu/presslist> and <http://creativemachines.cornell.edu/presslist>

TEACHING EXPERIENCE

Spring 2010 - present	TA Trainer / Graduate Teaching Specialist Facilitate twice yearly training of all new engineering graduate TAs through the Cornell Office of Engineering Learning Initiatives
Summer 2011	CATALYST Academy – Digital Design and 3D Printing Teaching Assistant to Prof. Hod Lipson
Fall 2009	Mechatronics (MAE 3780), Cornell University Teaching Assistant to Prof. Ephrahim Garcia
Spring 2008	Road Vehicle Dynamics II (MAE 454/554), University at Buffalo Course Grader for Dr. Edward Kasprzak
Fall 2007 and Fall 2006	Freshman Honors Colloquium (UE 102), University at Buffalo Teaching Assistant for University Honors College
Spring and Fall 2007	Tau Beta Pi Tutoring Program, University at Buffalo Tutor for Mechanical and Aerospace Engineering

STUDENTS ADVISED

All advised under Prof. Dr. Hod Lipson

Patrick Porter and Nikita Kiriya Fall 2011	Undergraduate Research <i>Learning material models for multi-material 3D printed objects</i>
Jesada Ungnapatanin Fall 2011	Master of Engineering <i>Design and testing of multi-material 3D printed specimens</i>
Abhinav Rao Summer 2011 - present	Undergraduate Senior Design <i>Untethered reconfigurable structures based on jamming actuators</i>
Ingmar Zanger Spring 2011 - present	Master of Engineering <i>Discovering fundamental vehicle dynamics equations</i>
Karen Ho Spring 2011	Master of Engineering <i>Estimating material models for 3D printed specimens</i>

HONORS & AWARDS

- NSF Graduate Research Fellowship Award, 2010
- Cornell Engineering Research Conference (CERC) Best Presentation in Session Award, 2010
- Sibley Graduate Research Conference (ReCon) Best Poster Award, 2010
- NSF Graduate Research Fellowship Program Honorable Mention Award, 2009
- Cornell Mechanical and Aerospace Engineering Fellowship Award, 2008
- University at Buffalo School of Engineering and Applied Sciences Senior Scholarship, 2008
- NSF CMMI Engineering Research and Innovation Conference Travel Grant Award, 2008
- NSF Research Experience for Undergraduates Award, 2007-2008
- University at Buffalo Honors College Scholarship, 2004-2008
- University at Buffalo Dean's List Award, recognized for all semesters, 2004-2008
- The Engineering Society of Buffalo Scholarship for Academics, 2004-2008

- NSF/ASME Design Essay Competition Winner, 2007
- ASME IDETC/CIE Conference Travel Grant Award, 2007
- Gustav and Greta Zimmer Research Scholar Award, 2007
- Townsend Scholarship Award for Academics in Engineering, 2005

ACTIVITIES & AFFILIATIONS

- Student Member, Institute of Electrical and Electronics Engineers (IEEE), 2010-present
- Student Member, American Society of Mechanical Engineers (ASME), 2009-present
- Student Member, American Society for Engineering Education (ASEE), 2009-present
- Member, Toastmasters International, Cornell Johnson School of Management Chapter, 2008-2010
- Participant, Cornell Engineering TA Development Program, 2009
- Participant, Cornell Center for Teaching Excellence Cross-cultural Classroom Dynamics Workshop, 2009
- Club Treasurer and Mechanical Team Leader, University at Buffalo Robotics Club, 2005-2008
- Member, Tau Beta Pi, Engineering Honor Society (former Vice President, NY Nu Chapter), 2007
- Member, Pi Tau Sigma, Mechanical Engineering Honor Society, 2007

RELATED SERVICE ACTIVITIES

- Reviewer
 - IEEE Transactions on Automation Science and Engineering
 - ASME IDETC/CIE – Mechanisms and Robotics Conference
- Corresponding consultant to elementary and high school robotics teams in Ann Arbor, MI; Manhasset, NY; and Kauai, HI; 2010-present
- Lab demonstration for Cornell Engineering Diversity Hosting Weekend, 2010
- Fifth grade robotics instructor for Student Teacher Outreach Mentorship Program, 2009-2010
- Cornell Engineering outreach for high school women and under-represented minorities, 2009
- Invited talk on engineering and robotics for Williamsville North High School students, 2009
- Robotics demonstrations for children at the Buffalo Museum of Science, 2005-2008
- Robotics presentations for Buffalo-area Engineering Awareness for Minorities (BEAM), 2005-2008