

EDUCATION

Yale University	New Haven, CT
<i>PhD in Mechanical Engineering</i>	2016
<i>Masters in Mechanical Engineering</i>	2012
Thesis: Strategies for Dexterous Manipulation with Underactuated Robotic Hands	
Massachusetts Institute of Technology	Cambridge, MA
<i>S.B. in Mechanical Engineering, S.B. in Electrical Engineering and Computer Science</i>	2010
Thesis: Torque Measurement w/ Low-cost Flexure Mechanisms	

WORK/RESEARCH EXPERIENCE

Yale University Grablab	New Haven, CT
<i>PhD Candidate</i>	Sept 2010 - Sept 2016

- Investigated use of compliant members and adaptive design for precision dexterous manipulation in underactuated robotic hands
- Built/tested tendon-driven, underactuated hands using casting and additive-manufacturing techniques
- Participated in DARPA ARM-H initiative in collaboration with Harvard University and iRobot
- Developed and maintained Yale OpenHand Project (www.eng.yale.edu/grablab/openhand)

MIT Precision Compliant Systems Laboratory	Cambridge, MA
<i>Undergraduate Researcher under Professor Martin Culpepper, Alex Slocum Jr., Dr. Jonathan Bean</i>	Oct 2009 - May 2010

- Developed proof of concept ankle joint medical evaluation device with compliant mechanisms
- Evaluated custom flexure designs as low-cost torque sensors

Kiva Systems	Woburn, MA
<i>Intern in Hardware Division</i>	May - August 2008

- Developed analysis programs in Matlab to parse drive unit and floor logs in order to playback action sequences, optimize movement performance, and debug floor offset errors
- Programmed protocols in Labview for automated control of battery-testing module for charging/discharging cycles

MIT Nuclear Reactor Laboratory	Cambridge, MA
<i>Programmer under Professor Gordon Khose, Yakov Ostrovsky</i>	May 2007 - May 2008

- Helped rebuild and test nuclear physics experiment for use in Junior Physics and Nuclear Radiation Measurement courses at MIT
- Programmed protocols in Labview for motion control with limit switch feedback, measurements with multichannel scanners and pulse counters

RELEVANT SKILLS

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- **Programming:** ROS, C/C++, Python, Matlab, Javascript, LabVIEW, Java, XHTML/CSS/PHP/MySQL
 - **Software:** Solidworks, Onshape, OpenSCAD, Dreamweaver, Flex Builder, Flash, Fireworks/Photoshop, MasterCAM, Omax, Matlab
 - **Engineering:** parametric CAD, CNC, machining, 3D-printing (FDM/SLA), DFA/DFM, FEA, urethane casting, injection molding, laser cutting, water jet

HONORS/MEMBERSHIP

National Science Foundation Fellowship Honorable Mention	2012
George P. O'Leary Fellowship - Yale University	2010-11
Honorable Mention de Florez Undergraduate Design Award - MIT	2010
2.007 Whitelaw Engineering Award - MIT	2008
Tau Beta Pi, Pi Tau Sigma, Phi Kappa Sigma Fraternity	

ICRA Tutorial Organizer

Jun 2013

- "Fabrication Techniques for Open-Source Robotic Hands"
- Helped organize/run a tutorial at 2013 International Conference on Robotics and Automation

Yale University Teaching Assistant

- ME489 (Fall 2011) - Mechanical Design Process
- STARS (Summer 2014) - Science, Technology, and Research Scholars program
- CPSC 679 (Spring 2016) - Computational Issues in 3D Design and Fabrication

Discover Mechanical Engineering (co-coordinator)

May - August 2008

- Co-coordinator for week-long freshmen pre-orientation program that introduced 32 incoming freshmen to mechanical engineering through construction of soccerbots
- Managed \$20k+ budget in 2008, participant/volunteer 2006-2010

JOURNAL PUBLICATIONS

R. Ma, J.T. Belter, and A.M. Dollar, "Hybrid Deposition Manufacturing: Design Strategies for Multi-Material Mechanisms via 3D-Printing and Material Deposition," *ASME Journal of Mechanisms and Robotics*, 7(2), 021002, 2015

L.U. Odhner, **R. Ma**, and A.M. Dollar, "Exploring Dexterous Manipulation Workspaces with the iHY Hand," *Journal of the Robotics Society of Japan*, 32(4), pp. 318-22, 2014

R. Ma and A.M. Dollar, "Linkage-Based Analysis and Optimization of an Underactuated Planar Manipulator for In-Hand Manipulation," *Journal of Mechanisms and Robotics*, 6(1), 011002, 2014

L.U. Odhner et al. "A Compliant, Underactuated Hand for Robust Manipulation," *International Journal of Robotics Research*, 33(5), pp. 736-52, 2014

L.U. Odhner, **R. Ma**, and A.M. Dollar, "Open-Loop Precision Grasping with Underactuated Hands Inspired by a Human Manipulation Strategy," *IEEE Transactions on Automation Science and Engineering*, 10(3), 2013

R. Ma et al. "Torque Measurement with Compliant Mechanisms." *Journal of Mechanical Design* 135, 2013

I. Bullock, **R. Ma**, and A.M. Dollar, "A Hand-Centric Classification of Human and Robot Dexterous Manipulation," *IEEE Transactions on Haptics*, 6(2), 2012.

E. Sung, A. Slocum Jr., **R. Ma**, J. Bean, M. Culpepper, "Design of an Ankle Rehabilitation Device using Compliant Mechanisms," *Journal of Medical Devices*, 5(1), 2011.

CONFERENCE PUBLICATIONS

R. Ma, N. Rojas, and A.M. Dollar, "Towards Predictable Precision Manipulation of Unknown Objects with Underactuated Fingers," *Proceedings of the 2015 IEEE International Conf. on Reconfigurable Mechanisms and Robotics (ReMAR 2015)* - *Best Student Paper*

R. Ma, A. Spiers, and A.M. Dollar, "M2 Gripper: Extending the Dexterity of a Simple, Underactuated Gripper," *Proceedings of the 2015 IEEE International Conf. on Reconfigurable Mechanisms and Robotics (ReMAR 2015)*

R. Ma and A.M. Dollar, "An Underactuated Hand for Efficient Finger-Gaiting-Based Dexterous Manipulation," *Proceedings of the 2014 IEEE International Conf. on Robotics and Biomimetics (ROBIO 2014)*

R. Ma, L.U. Odhner, and A.M. Dollar, "A Modular, Open-Source 3D Printed Underactuated Hand," *Proceedings of the 2013 International Conf. on Robotics and Automation (ICRA 2013)*.

L.U. Odhner, **R. Ma**, and A.M. Dollar, "Experiments in Underactuated In-Hand Manipulation," *Experimental Robotics (ISER 2012)*.

L.U. Odhner, **R. Ma**, and A.M. Dollar, "Precision Grasping and Manipulation of Small Objects from Flat Surfaces Using Underactuated Fingers," *Proceedings of the 2012 International Conf. on Robotics and Automation (ICRA 2012)*

R. Ma, A. Dollar, "On Dexterity and Dexterous Manipulation," *Proceedings of 2011 International Conf. on Advanced Robotics (ICAR 2011)*

R. Ma, A. Slocum Jr., E. Sung, J. Bean, M. Culpepper, "Ankle Rehabilitation via Compliant Mechanisms," *Proceedings of Design of Medical Devices Conference 2010*, Minneapolis, MN