

# CURRICULUM VITAE

## Zhe Xu

Center for Sensorimotor Neural Engineering (CSNE)  
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### EDUCATION

- **University of Washington, Seattle, WA**  
Ph.D., Computer Science & Engineering, 2015  
Advisors: Prof. Emanuel Todorov, Prof. Joshua Smith, and Prof. Yoky Matsuoka (former)
  - Dissertation: Design and Control of an Anthropomorphic Robotic Hand: Learning Advantages from the Human Body & Brain
- **University of Hawaii at Manoa, Honolulu, HI**  
Master of Science, Bioengineering, 2007
- **China Agricultural University, Beijing, China**  
Bachelor of Engineering, with distinction, Mechanical Engineering, 2004

### RESEARCH EXPERIENCE

- **Embotic Technology Inc.,**  
**Center for Sensorimotor Neural Engineering, University of Washington** (March 2017 ~ present)  
Chief Scientist & Co-founder
  - Conducting research on the highly biomimetic robotic hand towards commercialization.
- **GRAB Lab, Yale University** (April 2015 ~ February 2017)  
Post-doctoral Associate, Advisor: Prof. Aaron M. Dollar
  - Designed, controlled and analyzed a novel, self-sufficient digital fabrication system with reconfigurable materials.
- **Neurobotics and Moment Control Lab, University of Washington** (August 2008 ~ April 2015)  
Ph.D. student, Research Assistant
  - Designed and controlled the anatomically corrected testbed (ACT) hand and the highly biomimetic anthropomorphic robotic hand.
- **Healthcare Robotics Lab, Georgia Institute of Technology** (August 2007 ~ August 2008)  
MS student, Research Assistant
  - Designed, prototyped and controlled the Dusty robot.
- **University of Hawaii at Manoa** (August 2005 ~ May 2007)  
MS student, Research Assistant
  - Designed and modeled a novel multi-airlifting membrane bioreactor based on hydrodynamic and cell cultivation experiments.
- **National Key Laboratory, China Agricultural University** (March 2003 ~ February 2004)  
Undergraduate student
  - Designed and prototyped the inoculation machine.

## TEACHING EXPERIENCE

- **Hardware Design and Implementation** (CSE 352), Spring 2014  
Teaching Assistant
- **Introduction to Data Management** (CSE 344), Fall 2013  
Teaching Assistant
- **Introduction to Database Systems** (CSE 414), Spring 2013  
Teaching Assistant

## HONORS AND AWARDS

- First place, National Collegiate Mechanical Innovation Contest, China, August 2004
- Second place, Beijing Collegiate Mechanical Innovation Contest, June 2004
- Scholarships, China Agricultural University, all through 2001~2004

## SKILLS

- **Language:** English/Chinese (Mandarin)
- **Software and Programming:** AutoCAD, Pro/E, Solidworks, 3ds Max, Fluent (CFD software), C/C++, Python, Java.
- **Hardware:** PLC control, AC servo/step motor control, pneumatic system design, 3D-printing, rapid prototyping techniques.
- **Biology:** Cell cultivation, chemical analysis, bioreactor design.

## PUBLICATIONS

### Journals

1. **Zhe Xu** and Aaron M. Dollar. The CLaP System: Chain-based Lattice Printing for Efficient Robotically-Assembled Structures. *Science Robotics*, under review 2017.
2. **Zhe Xu**, Connor McCann, and Aaron M. Dollar. Reconfigurable Modular Chain: a Reversible Material for Folding 3D Lattice Structures. *ASME Journal of Mechanisms and Robotics*, 2017.
3. Ashish D. Deshpande\*, **Zhe Xu**\*, Michael J. Vande Weghe\*, Jonathan Ko, Lillian Y. Chang, Benjamin H. Brown, David D. Wilkinson, Sean M. Bidic, and Yoky Matsuoka. Mechanisms of the Anatomically Correct Testbed (ACT) Hand. *IEEE/ASME Transactions on Mechatronics*, 2013. (\* These authors are all first authors.)
4. **Zhe Xu** and Jian Yu. Hydrodynamics and Mass Transfer in a Novel Multi-Airlifting Membrane Bioreactor. *Chemical Engineering Science*, 2008.

### Book chapter

1. **Zhe Xu**. Approaching Human Hand Dexterity through Highly Biomimetic Design. In *Human Inspired Dexterity in Robotic Manipulation*. Tetsuyou Watanabe, Kensuke Harada, and Mitsunori Tada (Eds.). Elsevier, Forthcoming 2017.

### Conferences

1. Sarah Elliott, **Zhe Xu**, and Maya Cakmak. Learning Generalizable Surface Cleaning Actions from Demonstration. In *Proceedings of the IEEE International Symposium on Robot and Human Interactive Communication, 2017 (RO-MAN'17)*.
2. **Zhe Xu**, Connor McCann, and Aaron M. Dollar. Design of a Reconfigurable Modular Chain for Folding 3D Lattice Structures. In *Proceedings of the ASME IDETC Mechanisms and Robotics Conference, 2016*.
3. **Zhe Xu** and Emanuel Todorov. Design of a Highly Biomimetic Anthropomorphic Robotic Hand towards Artificial Limb Regeneration. In *Proceedings of the IEEE International Conference on Robotics and Automation, 2016 (ICRA'16)*.
4. **Zhe Xu**, Yoky Matsuoka, and Ashish D. Deshpande. Crocheted Artificial Tendons and Ligaments for the Anatomically Correct Testbed (ACT) Hand, In *Proceedings of the IEEE International Conference on Robotics and Biomimetics, 2015 (Robio'15)*.
5. **Zhe Xu** and Maya Cakmak. Enhanced Robotic Cleaning with a Low-cost Tool Attachment. In *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems, 2014 (IROS'14)*.
6. **Zhe Xu**, Svetoslav Kolev, and Emanuel Todorov. Design, Optimization, Calibration, and a Case Study of a 3D-Printed, Low-cost Fingertip Sensor for Robotic Manipulation. In *Proceedings of the IEEE International Conference on Robotics and Automation, 2014 (ICRA'14)*.
7. **Zhe Xu**, Vikash Kumar, and Emanuel Todorov. A Low-cost and Modular, 20-DOF Anthropomorphic Robotic Hand: Design, Actuation and Modeling. In *Proceedings of the IEEE-RAS International Conference on Humanoid Robots, 2013 (Humanoids'13)*.
8. Vikash Kumar, **Zhe Xu**, and Emanuel Todorov. Fast, Strong and Compliant Pneumatic Actuation for Dexterous Tendon-driven Hands. In *Proceedings of the IEEE International Conference on Robotics and Automation, 2013 (ICRA'13)*.
9. **Zhe Xu**, Rebecca Fiebrink, and Yoky Matsuoka. Virtual Therapist: A Phantom Robot-Based Haptic System for Personalized Post-Surgery Finger Rehabilitation. In *Proceedings of the IEEE International Conference on Robotics and Biomimetics, 2012 (ROBIO'12)*.
10. **Zhe Xu**, Vikash Kumar, Yoky Matsuoka, and Emanuel Todorov. Design of an Anthropomorphic Robotic Finger System with Biomimetic Artificial Joints. In *Proceedings of the IEEE International Conference on Biomedical Robotics and Biomechatronics, 2012 (Biorob'12)*.
11. **Zhe Xu**, Brian Dellon, and Yoky Matsuoka. Design of Artificial Skin with Integrated Tactile Sensors for Anthropomorphic Robotic Hands. In *Proceedings of the IEEE International Conference on Robotics and Biomimetics, 2011 (Robio'11)*.
12. **Zhe Xu**, Emanuel Todorov, Brian Dellon, and Yoky Matsuoka. Design and Analysis of an Artificial Finger Joint for Anthropomorphic Robotic Hands. In *Proceedings of the IEEE International Conference on Robotics and Automation, 2011 (ICRA'10)*.
13. **Zhe Xu**, Travis Deyle, and Charles C. Kemp. 1000 Trials: An Empirically Validated End Effector that Robustly Grasps Objects from the Floor. In *Proceedings of the IEEE International Conference on Robotics and Automation, 2009 (ICRA'09)*.
14. Charles C. Kemp, Cressel Anderson, Hai Nguyen, Alexander J. Trevor, and **Zhe Xu**. A Point-and-Click Interface for the Real World: Laser Designation of Objects for Mobile Manipulation. In *Proceedings of the 3rd ACM/IEEE International Conference on Human-Robot Interaction, 2008 (HRI'08)*.

### **Workshop papers**

1. Hai Nguyen, Cressel Anderson, Alexander J. Trevor, Advait Jain, **Zhe Xu**, and Charles C. Kemp. EI-E: An

Assistive Robot that Fetches Objects from Flat Surfaces. *HRI Workshop on Robotic Helpers: User Interaction, Interfaces and Companions in Assistive and Therapy Robots*, 2008.

2. **Zhe Xu** and Maya Cakmak. Robot Factors: An Alternative Approach for Closing the Gap in Human versus Robot Manipulation. *Robotics: Science and Systems (RSS) Workshop: Human versus Robot Grasping and Manipulation -- How Can We Close the Gap*, Berkeley, 2014.

### **Patents**

1. **Zhe Xu**, Emanuil Todorov. "Design of a highly biomimetic anthropomorphic robotic hand." U.S. Provisional Pat. Ser. No. 62/376,813, filed August 18, 2016.
2. Kemp, Charles C., **Zhe Xu**, and Zhengqin Fan. "Mobile robot and method for object fetching." U.S. Patent Application 13/021,300, filed February 4, 2011.
3. Tiezhong Zhang, He Xu, and **Zhe Xu**. "Spray nozzle for automatic inoculation." CN1331609 C, issued August 15, 2007.
4. Tiezhong Zhang, **Zhe Xu**, and He Xu. "Spray based inoculation device." CN1308433 C, issued April 4, 2007.

### **INVITED TALKS AND GUEST LECTURES**

1. *Orthotic & Prosthetic Innovation & Technology Conference: Driving the Future of O&P*, Invited Talk, University of California, San Francisco (UCSF), October 2016.
2. *Workshop on Dexterity Acquisition in Object Manipulation*, Invited talk, IROS 2016, Daejeon, South Korea, October 2016.
3. *Intelligent Control through Learning and Optimization Course Guest Lecture*, Department of Computer Science & Engineering, University of Washington, April 2015.
4. *Robotics Colloquium*, University of Washington, February 2015.

### **SELECT PRESS AND MEDIA COVERAGE**

1. *Scientific American Mind Magazine*, also on the website of Scientific American, "Tomorrow's Prosthetic Hand: Recent Breakthroughs in Technology Could Mean a Fully Functional Artificial hand May be on the Horizon," August 2016.
2. *BBC Focus Magazine*, "Fingertip Control: Researchers Create the Most Advanced Prosthetic Hand Yet," June 2016.
3. *Unmanned Systems Magazine*, "Let the Robot Do It," June 2016.
4. *Popular Mechanics website*, "The Robotic Hand of the Future is Finally Here," February 2016.
5. *Discovery website*, "3D-Printed Hand Could Serve as Scaffold for Living Tissue," February 2016.
6. *Business Insider*, "Researchers Want to Grow Human Tendons on an Incredibly Advanced Robotic Hand," February 2016.
7. *Quartz*, "Scientists Have Made a Ridiculously Lifelike Robot hand That Act a Lot Like Our Own," February, 2016.
8. *Yahoo Finance*, "Researchers Want to Grow Human Tendons on an Incredibly Advanced Robotic Hand," February 2016.
9. *Slate*, "This Mechanical hand is Larger than Life," February 2016.
10. *Daily Mail*, "Introducing the Biomimetic Anthropomorphic Robotic hand" (video) & "Is This the Most Lifelike Robotic Hand Ever? Engineers Create 3D-Printed Digits Complete with Crocheted Tendons and

- Rubber Tissue" (article), February 2016.
11. *Medgadget*, "New Robotic Hand Made to Replicate the Real Deal," February 2016.
  12. *Gizmodo*, "This Insanely Detailed Robotic hand Works Just Like the Real Thing," February 2016.
  13. *3ders*, "This Amazing Biomimetic Anthropomorphic Robotic Hand Contains 3D Printed Bones," February 2016.
  14. *IEEE Spectrum website*, "This is the Most Amazing Biomimetic Anthropomorphic Robot Hand We've Ever Seen," February 2016.
  15. *News website of The Paul Allen School of Computer Science & Engineering at the University of Washington*, "UW CSE Researchers Create 'The Most Amazing' Robot hand IEEE Spectrum Has Ever Seen," February 2016.
  16. *News website of the Temporal Dynamics of Learning Center (NSF Science and Learning Center) at the University of California*, "This Remarkable Robot Hand is Worthy of Luke Skywalker," February 2016.
  17. *Documentary by the National Science Foundation*, "Brain-Computer Interface-Mysteries of the Brain," June 2015.
  18. *IEEE Spectrum website*, "Simple 3D Printed Grip Makes Household Robots a Little More Realistic," September 2014.
  19. *Newsletter CS Bits & Bytes (National Science Foundation)*, "Biomimetic Robots," September 2012.