

I am a robotics researcher and leader with a passion for developing thoughtfully and creatively considered robotic systems that excite and inspire. I have especially great interest in humanoid robots making soft, rich-contact with the world including physical human-robot interactions. I have international experience working and researching on diverse teams in both academia and industry.

## ● experience

**Toyota Research Institute (TRI)** Manager and Technical Lead, Whole-Body Manipulation **Cambridge, MA** 02.2020 - Present

- Pitched and lead multi-department project building soft, sensing hardware and algorithms for whole-body manipulation and interaction ([bit.ly/pnyo1](http://bit.ly/pnyo1))
- Proposed and co-investigate multiple joint research projects on robot hands and “superhuman” sensing with MIT, Stanford, CMU, and UIUC
- Co-organize annual “Can we build Baymax?” workshop at the International Conference on Humanoid Robots with leading researchers ([baymax.org](http://baymax.org))
- Communicate and collaborate with Toyota research and mfg. partners in North America and Japan to promote technology transfer and adoption
- Manage a diverse, multi-disciplinary team ranging from young engineers and interns to senior and staff researchers and software developers

**Toyota Research Institute (TRI)** Robotics Hardware Engineer, Tactile Sensing **Cambridge, MA** 01.2017 - 02.2020

- Developed novel highly-compliant visuotactile geometry, pressure, and shear sensor for robust manipulation and physical interaction ([pnyo.tech](http://pnyo.tech))
- Sole mechanical engineer for Cambridge-based manipulation team; Compliant gripper design for mugs, dishes, and silverware ([bit.ly/dishfingers](http://bit.ly/dishfingers))
- Played major role in \$8M build-out and equipment purchasing for TRI’s new multi-team Cambridge robotics lab

**Disney Research** Robotics Research Associate **Pittsburgh, PA** 10.2014 - 12.2016

- Designed and fabricated soft, tactile sensing humanoid robots and grippers for gentle physical human-robot interaction ([bit.ly/softbody](http://bit.ly/softbody))
- Created novel robot systems including magnetically reconfigurable legs ([bit.ly/snapbt](http://bit.ly/snapbt)) and a computationally-optimized “tetrabot” walker ([bit.ly/tetrabt](http://bit.ly/tetrabt))
- Built wearable human-machine interfaces using new techniques including 3D printing rubber and CNC thin film antenna cutting ([bit.ly/emsense](http://bit.ly/emsense))

**SimLab Co. Ltd.** Robotics Engineer **Seoul, South Korea** 08.2012 - 09.2014

- Contributed on engineering, mfg., and repair for robotics research hardware products Allegro Hand, Arm, and Dog ([bit.ly/allegrohnd](http://bit.ly/allegrohnd))
- Developed and maintained robotic hand software and documentation for Windows (RoboticsLab), Linux (ROS), and Android ([bit.ly/allegrowiki](http://bit.ly/allegrowiki))
- Managed international sales, marketing, and training for robotic hand, Allegro Hand, and quadruped, Allegro Dog
- UX design and software development for toolset enabling digital artists to animate complex, constrained, and synchronized robot motions ([bit.ly/mavrbt](http://bit.ly/mavrbt))
- Worked closely with artists and producers to create a comfortable, effective interface and workflow to facilitate creative, productive results

**Czech Technical University** Exchange Researcher **Prague, Czech Republic** 04.2012

- Studied the development and usage practices for the lab’s internet-accessible multi-robot testbed, SyRoTek
- Documented challenges and features relevant to a Drexel-based internet-accessible HUBO2 humanoid robot testbed
- Implemented navigation algorithms and presented user-perspective suggestions for improvements to the system

**KAIST Humanoid Robotics (HUBO) Lab** Robotics Researcher **Daejeon, South Korea** 09.2010 - 03.2011

- Built comprehensive online assembly and setup manuals to accompany HUBOs exported from KAIST to U.S. universities
- Learned manufacture, assembly, troubleshooting, maintenance, and repair methods as part of the U.S. team of HUBO specialists
- Contributed to international awareness, engagement, and collaboration in the field of robotics

**Synthes, Inc.** Product Development Engineering Intern (Spine Division) **West Chester, PA** 09.2009 - 03.2010

- Co-Investigator for a high-priority biomechanical product failure analysis and next generation design

**Max Levy Autograph, Inc.** Research and Design Engineering Intern **Philadelphia, PA** 09.2008 - 03.2009

- Designed processes, methodologies, and mechanical equipment for depositing thin film resistors and circuits onto flexible substrates

**Drexel Autonomous Systems Lab (DASL)** Robotics Researcher **Philadelphia, PA** 03.2008 - 06.2012

- Primary member of int’l research, presentation, maintenance, and training teams for HUBO2, HUBO+, MiniHUBO, and DARwIn-OP humanoids
- Manufactured miniature humanoid, MiniHUBO, and developed manipulation, navigation, and dynamic walking algorithms ([bit.ly/minihubo](http://bit.ly/minihubo))
- Designed, built, and programmed many systems including force/torque sensing feet, a drivable vehicle for mini-humanoids, and CNC 3-axis gantry

## ● education

**Drexel University** **Philadelphia, PA**

Master of Science and Bachelor of Science in Mechanical Engineering & Mechanics

**focus** Autonomous Systems and Control

**lab** Drexel Autonomous Systems Lab (DASL) - Dr. Paul Oh

**thesis** A Humanoid Robot Pushing Model Inspired by Human Motion

2012

## ● skills

**code** MATLAB, Python, MediaWiki, HTML, CSS, LaTeX  
**cad & mfg** Solidworks, Pro/E, Inventor, nTop, Mastercam, CNC, Advanced 3D printing, Laser cutting, Casting, Screen printing  
**robotics** ROS, Webots, RoboticsLab, V-rep, Arduino, RasPi, Dynamixel, Visuotactile sensing  
**design** Photoshop, Illustrator, Premiere Pro, Maya, 3ds Max, 3D modeling & printing, Web design, Fine art, Lithography  
**proj. leadership** Budgeting, Asana, OKR development, SWOT analysis, Project proposals, Exec-level pitches and presentations, **Kaizen**  
**language** English (native), Korean 한국어 (conversational / intermediate)


## ● peer-reviewed publications

A. Goncalves, N. Kuppuswamy, A. Beaulieu, A. Uttamchandani, K.M. Tsui, and **A. Alspach**.  
Punyo-1: Soft Tactile-Sensing Upper-Body Robot for Large Object Manipulation and Physical Human Interaction. *Robosoft*, 2022.

S. Joonhigh, N. Kuppuswamy, A. Beaulieu, **A. Alspach**, and R. Tedrake.  
Variable Compliance and Geometry Regulation of Soft-Bubble Grippers with Active Pressure Control. *Robosoft*, 2021.

R. Ambrus, V. Guizilini, N. Kuppuswamy, A. Beaulieu, A. Gaidon, and **A. Alspach**.  
Monocular Depth Estimation for Soft Visuotactile Sensors. *Robosoft*, 2021.

N. Kuppuswamy, **A. Alspach**, A. Uttamchandani, S. Creasey, T. Ikeda, and R. Tedrake.  
Soft-Bubble grippers for robust and perceptive manipulation. *IROS*, 2020.

 N. Kuppuswamy, A. Castro, C. Phillips-Grafflin, **A. Alspach**, and R. Tedrake.  
Fast Model-Based Contact Patch and Pose Estimation for Highly Deformable Dense-Geometry Tactile Sensors. *ICRA, RA-L*, 2020. Journal Publication. **Best Paper Award**.

A. Castro, A. Qu, N. Kuppuswamy, **A. Alspach**, and M. Sherman.  
A Transition-Aware Method for the Simulation of Compliant Contact with Regularized Friction. *ICRA, RA-L*, 2020. Journal Publication.


**A. Alspach**, K. Hashimoto, N. Kuppuswamy, and R. Tedrake.  
Soft-bubble: A highly compliant dense geometry tactile sensor for robot manipulation. *Robosoft*, 2019.

S. Ha, S. Coros, **A. Alspach**, J. Bern, J. Kim, and K. Yamane.  
Computational Design of Robotic Devices from High-Level Motion Specifications. *T-RO*, 2018. Journal Publication.

S. Ha, S. Coros, **A. Alspach**, J. Kim, and K. Yamane.  
Computational Co-Optimization of Design Parameters and Motion Trajectories for Robotic Systems. *IJRR*, 2018. Journal Publication.

**A. Alspach**, J. Kim, and K. Yamane.  
Design and Fabrication of a Soft Robotic Hand and Arm System. *RoboSoft*, 2018.

J. Kim, **A. Alspach**, and K. Yamane.  
Snapbot: A Reconfigurable Legged Robot. *IROS*, 2017.

 S. Ha, S. Coros, **A. Alspach**, J. Kim, and K. Yamane.  
Joint Optimization of Robot Design and Motion Parameters using the Implicit Function Theorem. *RSS*, 2017. **Best Paper Award Finalist**.

S. Ha, S. Coros, **A. Alspach**, J. Kim, and K. Yamane.  
Task-Based Limb Optimization for Legged Robots. *IROS*, 2016.

A. Lawrence, **A. Alspach**, and D. Bentivegna.  
Mechanical Implementation of a Variable-Stiffness Actuator for a Softly Strummed Ukulele. *IROS*, 2016.

J. Kim, **A. Alspach**, I. Leite, and K. Yamane.  
Study of Children's Hugging for Interactive Robot Design. *RO-MAN*, 2016.

 P. Agarwal, S. Al Moubayed, **A. Alspach**, J. Kim, E. Carter, J. Lehman, and K. Yamane.  
Imitating Human Movement with Teleoperated Robotic Head. *RO-MAN*, 2016. **Best Technical Paper Award**.

 **A. Alspach**, J. Kim, and K. Yamane.  
Design of a Soft Upper Body Robot for Physical Human-Robot Interaction. *Humanoids*, 2015. **Best Oral Paper Award Finalist**.

R. Sagawa, Y. Yoshiyasu, **A. Alspach**, K. Ayusawa, K. Yamane, and A. Hilton.  
Analyzing Muscle Activity and Force with Skin Shape Captured by Non-contact Visual Sensor. *PSIVT*, 2015.

J. Kim, **A. Alspach**, and K. Yamane.  
3D Printed Soft Skin for Safe Human-Robot Interaction. *IROS*, 2015.

Y. Jun, **A. Alspach**, and P.Y. Oh.  
Controlling and Maximizing the Humanoid Robot Pushing Force by Postures. *URAI*, 2012.

R. Ellenberg, R. Sherbert, P.Y. Oh, **A. Alspach**, R. Gross, and J.H. Oh.  
A Common Interface for Humanoid Simulation and Hardware. *Humanoids*, 2010.

## ● issued patents

Systems and methods for determining pose of objects held by flexible end effectors. U.S. Patent 11389968.

Deformable sensors having multiple time-of-flight emitters. U.S. Patent 11185994.

Deformable sensors and methods for detecting the pose and force on an object. U.S. Patent 10668627.

Systems and methods of calibrating a depth-IR image offset. U.S. Patent 10628968.

Robots with compliant contact and geometry sensors having varying touch sensitivity. U.S. Patent 10549428.

Computational design of robots from high-level task specifications. U.S. Patent 10248085.

Soft Body Robot for Physical Interaction with Humans. U.S. Patent 9802314.