Alex Alspach

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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.

● education

Drexel University   **Philadelphia, PA**
Master of Science and Bachelor of Science in Mechanical Engineering & Mechanics   2012
focus   Autonomous Systems and Control

lab   Drexel Autonomous Systems Lab (DASL) - Dr. Paul Oh
thesis   A Humanoid Robot Pushing Model Inspired by Human Motion

● 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)
• 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)
• 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 (punyo.tech)
• Sole mechanical engineer for Cambridge-based manipulation team; Compliant gripper design for mugs, dishes, and silverware (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/softbdy)
• Created novel robot systems including magnetically reconfigurable legs (bit.ly/snapbt) and a computationally-optimized "tetrabot" walker (bit.ly/tetrabt)
• Built wearable human-machine interfaces using new techniques including 3D printing rubber and CNC thin film antenna cutting (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)
• Developed and maintained robotic hand software and documentation for Windows (RoboticsLab), Linux (ROS), and Android (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)
• 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)
• Designed, built, and programmed many systems including force/torque sensing feet, a drivable vehicle for mini-humanoids, and CNC 3-axis gantry

● 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)

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● 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 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.

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

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.

For full list of pending patent applications as well as links to all publications, please visit alexalspach.com/cv.