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Matthew A. Robertson

Robotics & Mechanical Design Engineer
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Curriculum Vitae

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EDUCATION

2016-Present **Ph.D. Candidate** in Robotics, École Polytechnique Fèdèrale de Lausanne (EPFL), Lausanne Switzerland

2011 **M.S.E.** Mechanical Engineering: Control Theory, University of Michigan, Ann Arbor, MI, USA

2009 **S.B.** Mechanical Engineering: Robotics, Massachusetts Institute of Technology (MIT), Cambridge, MA, USA

EXPERIENCE

2016-Present **Graduate Student** Reconfigurable Robotics Laboratory

Proposed thesis investigates soft robotic technologies and systems for wearable or assistive devices. Conceived, implemented and tested new fabrication, control, and system integration concepts with complex, multi-DoF soft actuation-based mechanical prototypes.

2015 **Robotics Mechanical Engineer** HStar Technologies

Conceptual and detailed design and development of personal robotic systems for home and healthcare industries. Includes telepresence robots and assistive technologies for nursing.

2011-2015 **Research Engineer** Intelligent Prosthetic Systems

Project Lead handling scientifically motivated design, fabrication, assembly and testing of advanced prosthetic devices under research. Includes novel mechanisms, low-power actuation, microcontroller and sensor integration (Inertial Measurement Units), and management of human-subject testing protocols and analysis.

2011-2015 **Research Engineering Assistant** University of Michigan HBCL

Providing laboratory management, engineering support for graduate students in university Human Biomechanics and Control Laboratory.

2009-2012 **Contract Consulting** MA, MI

Design and fabrication services for mechanical/electrical hardware prototypes. Completed projects include: windmill, tattoo machine, robotic positioning systems, marine mammal research testing apparatus, mechatronic children's museum exhibit

2011 **Robotics Engineer** Vishwa Robotics

Project Lead and design engineer for various DOD SBIR contract engineering projects.

2010-2011 **Graduate Research** University of Michigan GRRC

Investigation and design of a pneumatic binary-actuation hyper-redundant robotic manipulator-arm.

2010 **Air Force Research Lab Internship** Kirtland Air Force Base

Studied, designed, and modeled deployable systems for CubeSat standard micro satellites.

2009 **Research & Development Internship** Aurora Flight Sciences

Designed, modeled, fabricated, and tested hardware, software, and electronics for prototype Micro Air Vehicles (MAV) and autonomous multi-vehicle coordination testing and demonstration.

2008 **Undergraduate Research** MIT D'Arbeloff Laboratory

Designed and built a heavy-duty, 2-axis, dual gantry system to position 60 lb payloads throughout a large workspace with 0.01 inch accuracy. Independent management of design, project planning, requisition, fabrication, and assembly.

2008 **Undergraduate Research** MIT D'Arbeloff Laboratory

Designed, built, and tested alpha-prototype robotic platform to investigate the feasibility of active pneumatic suction cup adhesion to aluminum aircraft "skin" for robotic assembly research.

TEACHING

2016-2018 **Graduate Teaching Assistant** EPFL / RRL Mechanical Engineering

Assisted Master's-level graduate course "ME-410: Mechanical product design and development", with focus on wearable and assistive technology. Specific topics include soft robotics and smart materials. Helped plan curriculum, taught lectures, designed and ran practical sessions, weekly update meetings, and semester-long project development.

2016 **Graduate Teaching Assistant** EPFL / RRL Mechanical Engineering

Assisted undergraduate course "ME-302: Mechanical Design Principles". Staffed weekly homework assistance, taught exam review session, and graded assignments and exams.

2007-2008 **Engineering Design Teacher** MIT Edgerton Center / TEC

Taught at MIT and instructed on subjects of design, computer modeling, physics, motor dynamics, and machine tool use. Students designed and fabricated remote controlled robots for competitions, and ridable machines (go-kart, DIY-Segway). Saturday program during multiple semesters, and month long summer / winter sessions.

SKILLS

- **Mechanical Design**
- **Soft Materials Robot Fabrication**
- **Modeling -** Solidworks, Alibre
- **Manufacturing -** Bridgeport, Smithy, Hardinge, Colchester, Makerbot, Epilog
- **Materials Testing -** Instron
- **Programming -** C/C++, Matlab, Java, VBA, Scheme, Processing
- **CNC Programming -** MasterCAM, OMAX, AlibreCAM
- **PCB, Circuit Fabrication**
- **Concept Sketch Drawing**

ACTIVITIES

- **FIRST Robotics** Team mentor, former student participant, 7 years
- **Singing** Men's college a cappella group, soloist, MITLogs.com
- **Art** Wood Carving, Painting, Drawing (various media)
- **Rock Climbing/Bouldering, Running, Hiking, Tough Mudder…ing?** Any excuse to be outside
- **Home Renovation** Demolition and Reconstruction of first owned house (3 years)
- Dreaming and Doing at **Hacker/Maker-spaces**
- **Hobby Engineering** Designing and building things for fun

GENERAL INTEREST KEYWORDS

Novel actuators
Soft robotic systems
Heuristic design
Dynamic walking robots
Decentralized control
Modular robotics
Smart materials
Bioinspired machines

PUBLICATIONS

M. A. Robertson, O. Kara, J. Paik, Soft pneumatic actuator driven origami inspired modular robotic "pneumagami", in **International Journal of Robotics Research,** In review, Submitted Jan. 2019.

M. A. Robertson, M. Murakami, W. Felt, J. Paik, A Compact Modular Soft Surface with Reconfigurable Shape and Stiffness, in **IEEE Transactions on Mechatronics.** vol. 24, no. 1, pp. 16-24, Feb. 2019.

M. A. Robertson, F. Efremov, J. Paik. RoboScallop: Bivalve inspired swimming robot. **IEEE Robotics and Automation Letters,** doi: 10.1109/LRA.2019.2897144, Feb. 2019

M. A. Robertson and J. Paik. New soft robots really suck: Vacuum-powered systems empower diverse capabilities, in **Science Robotics**, vol. 2, num. 9, p. eaan6357, 2017.

M. A. Robertson, H. Sadeghi, J. M. Florez and J. Paik. Soft Pneumatic Actuator Fascicles for High Force and Reliability, in **Soft Robotics**, vol. 4, num. 1, p. 23-32, 2017.5

G. Agarwal, M. A. Robertson, H. A. Sonar and J. Paik. Design and Computational Modeling of a Modular, Compliant Robotic Assembly for Human Lumbar Unit and Spinal Cord Assistance, in **Scientific Reports**, vol. 7, p. 14391, 2017.

S. Hauser, M. A. Robertson, A. J. Ijspeert,J. Paik. JammJoint: A Variable Stiffness Device Based on Granular Jamming for Wearable Joint Support. **IEEE Robotics and Automation Letters**. PP. 1-1. 10.1109/LRA.2017.2655109. 2017.

CONFERENCES

M. A. Robertson, F. Efremov, J. Paik. RoboScallop: A bivalve inspired swimming robot. *2019 IEEE International Conference on Robotics and Automation (ICRA).* Montreal, Canada, May 20-24, 2019.

M. A. Robertson, L. Dejace, S. Lacour, J. Paik. Bi-modal control of vacuum-powered soft pneumatic actuators with embedded liquid metal-based strain sensitive. *2019 IEEE International Conference on Soft Robotics (RoboSoft)*, Seoul, Korea, April 14-18, 2019.

M. A. Robertson, J. Paik. Low-inertia vacuum-powered soft pneumatic actuator coil characterization and design methodology. *2018 IEEE International Conference on Soft Robotics (RoboSoft)*, Livorno, Italy, April 24-28, 2018.

W. Felt, M. A. Robertson, J. Paik. Modeling Vacuum Bellows Soft Pneumatic Actuators with Optimal Mechanical Performance. *2018 IEEE International Conference on Soft Robotics (RoboSoft),* Livorno, Italy, April 24-28, 2018.

S. Walker, A. Firouzeh, M. Robertson, Y. Menguc, J. Paik. 3D Printed Soft Sensor-Actuator Wearable for Facial Rehabilitation, Initial Work. *2018 IEEE International Conference on Soft Robotics (RoboSoft),* Livorno, Italy, April 24-28, 2018.

M. A. Robertson and J. Paik. Foam-based Vacuum-powered Soft Pneumatic Actuators (V-SPAs) for safe robots. *Talk at Humanoids Conference Workshop: Can We Build Baymax? Part III*, November 15, 2017.

H. A. Sonar, S. D. Joshi, M. A. Robertson and J. Paik. Interactive soft pneumatic actuator skin*. Presented at IEEE/RSJ International Conference on Intelligent Robots and Systems*, Vancouver, BC, Canada, 2017.

M. A. Robertson and J. Paik. Practical control methods for vacuum driven soft actuator modules. *Talk at IEEE Intl. Conf. on Intelligent Robots and Systems (IROS) 2017,* September 24-28, 2017.

M. A. Robertson, J. Paik, A. Ijspeert and A. Wu. A low-cost, actuated passive dynamic walker kit for accessible research and education. *Talk at Dynamic Walking Conference*, Mariehamn, Finland, 2017.

M. A. Robertson and J. Paik. Trunk postural tracking of assistive soft pneumatic actuator belt. *Presented at Dynamic Walking Conference*, Holly, MI, 2016.

P. G. Adamczyk, M. A. Robertson, and A. D. Kuo. RoboFrog? Explosive Power from Elastic Tendons Without Escapements. *Presented at Dynamic Walking Conference,* Pensacola, FL, 2012.