Lucas **Tiziani**
Robotics Engineer

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Research Focus

Robot Motion Planning	Trajectory planning of dynamic maneuvers for compliantly-actuated robots
Robot Optimization	Optimization of robot morphologies to enhance the agility and adaptability of compliantly-actuated robots

Education

Georgia Institute of Technology   Atlanta, GA
PhD, Mechanical Engineering, GPA: 3.92   June 2021
Thesis: *Sensing, Design Optimization, and Motion Planning for Agile*
        Pneumatic Artificial Muscle-Driven Robots

Georgia Institute of Technology   Atlanta, GA
MS, Mechanical Engineering, GPA: 4.0   May 2019

Union College   Schenectady, NY
BS, Mechanical Engineering, GPA 3.95   June 2011

Experience

Georgia Institute of Technology   Atlanta, GA
Graduate Research Assistant   Aug 2015–Present
Developed hardware, design optimization strategies, and motion planning algorithms to maximize the dynamic performance of compliantly-actuated robots

- Constructed trajectory optimization framework to plan high-speed motion sequences for pneumatic muscle-actuated robots
- Developed legged robot simulator with ground-contact modeling, pneumatic system dynamics, and muscle force dynamics; utilized simulator to optimize robot morphology for jumping tasks
- Developed and integrated pressure controller and gait-phase estimation assistance controller for pneumatically-actuated knee exoskeleton, run on ARM microcontroller & Raspberry Pi (ROS)
- Designed high-strain conductive liquid metal and optical reflectance sensors for position and force estimation of 'pneumatic artificial muscle' actuators

Waters Corporation   Milford, MA
Mechanical Engineer II, R&D   March 2014–July 2015
Developed an analytical-scale fraction collector instrument for integration with Ultra Performance Liquid Chromatography (UPLC) systems

- Optimized instrument fluidics to achieve lower sample dispersion than any competitive product
- Assisted in the development of a peak detection algorithm for real-time detection/collection of chromatographic peaks; created a Python-based app to evaluate and improve the algorithm
- Devised several patented features to significantly improve fraction recovery and reduce cross-fraction contamination

Waters Corporation   Milford, MA
Mechanical Engineer I, R&D   Oct 2011–Marc 2014
Led the development of a low-dispersion flow-splitting interface between UPLC systems and mass spectrometry instruments

- Created an analytical flow model to characterize key splitter parameters—split ratio, pressure drop, and split flow time offset—over full range of chromatographic operating conditions (varying flow rates, compositions, temperatures, pressures, etc.); verified model accuracy via experimental data
- Optimized splitter design using analytical model to maximize chromatographic operating range
- Performed computational fluid dynamics analysis and chromatographic testing to reduce fluidic dispersion of flow splitter

General Electric Global Research Center   Niskayuna, NY
Edison Intern   Summer 2010
Supported the development of a carbon fiber composite aircraft engine fan case for fan blade failure containment

- Performed automation of carbon fiber fan case layups
- Assisted with design, fabrication, testing, and analysis of prototype cases

Recognition

Honorable Mention, NSF Graduate Research Fellowship Program   2018
Mortimer F. Sayre Prize, Awarded by Union College ME faculty to student with best   2011
    potential for furthering the ideals of the mechanical engineering profession
Daniel F. Pullman Engineering Prize, First in graduating engineering class   2011
All-Academic Team, Upper New York State Collegiate Swimming Association   2009–2011
Presidential Scholarship, Union College   2007–2011

Teaching & Mentorship

Graduate Teaching Practicum   Atlanta, GA
ME8843: Biomechatronics of Wearable Robotic Systems   Spring 2020
For this special topics course at Georgia Tech, I helped develop lectures on mechatronic system design and control for wearable systems; I taught lectures to graduate students and led literature discussions.

Undergraduate Research Mentor   Atlanta, GA
Adaptive Robotic Manipulation Lab   2016-2021
I guided undergraduate students through various research projects, from performing literature reviews, to formulating research questions and evaluating potential solutions.

Lab Guide   Atlanta, GA
National Robotics Week   2015-2020
For National Robotics Week every Spring, I led demonstrations of robots in the ARM Lab at Georgia Tech for students from elementary to high school.

Service

Reviewer   Soft Robotics Journal (SoRo)
                 IEEE International Conference on Robotics and Automation (ICRA) 2020
                 IEEE International Conference on Soft Robotics (RoboSoft) 2020
                 IEEE International Conference on Soft Robotics (RoboSoft) 2019

Publications

[1] **Lucas Tiziani**, Yetong Zhang, Frank Dellaert, and Frank L. Hammond III. Factor Graph-Based Trajectory Optimization for a Pneumatically-Actuated Jumping Robot. Accepted for publication, *IEEE International Conference on Robotics and Automation (ICRA) 2021*.

[2] Alexander Ambrose, **Lucas Tiziani**, Donald Ward, Maxwell Weinmann, and Frank L. Hammond III. A Pneumatic Compression Vest for Transthoracic Manipulation of Ventilation-Perfusion in Critical Care Patients with Acute Respiratory Distress Syndrome Caused by COVID-19. Accepted for publication, *Design of Medical Devices Conference (DMD) 2021*.

[3] Donald Ward, Brian Epstein, **Lucas Tiziani**, and Frank L. Hammond III. Optimal Design of a Mechatronic Lever Arm for Pneumatic Exoskeleton: Design and Validation. Accepted for publication, *Design of Medical Devices Conference (DMD) 2021*.

[4] **Lucas Tiziani** and Frank L. Hammond III. Optical Sensor-Embedded Pneumatic Artificial Muscle for Position and Force Estimation. *Soft Robotics Journal, August 2020*.

[5] Jennifer Molnar, Ching-An Cheng, **Lucas Tiziani**, Byron Boots, and Frank L. Hammond III. Optical Sensing and Control Methods for Soft Pneumatically Actuated Robotic Manipulators. *IEEE International Conference on Robotics and Automation (ICRA)* 2018.

[6] Alexander Hart, **Lucas Tiziani**, Ji Hwan Jung, and Frank L. Hammond III. Deformable reflective diaphragm sensors for control of soft pneumatically actuated devices. *IEEE International Conference on Soft Robotics (RoboSoft)* 2018.

[7] **Lucas Tiziani**, Alexander Hart, Thomas Cahoon, Faye Wu, H. Harry Asada, and Frank. L. Hammond. Empirical characterization of modular variable stiffness inflatable structures for supernumerary grasp-assist devices. *The International Journal of Robotics Research, July 2017*.

[8] **Lucas Tiziani**, Thomas Cahoon, and Frank L. Hammond. Sensorized pneumatic muscle for force and stiffness control. *IEEE International Conference on Robotics and Automation (ICRA) 2017*.

Patents

[1] J. A. Burnett, J. Usowicz, M. Lemelin, **L. O. Tiziani**, A. Lebeau. *Liquid flow rate measurement device*. US 10175209 B2. 2019.

[2] M. R. Jackson, J. E. Usowicz, **L. O. Tiziani**, J. A. Jarrell, D. P. Wittmer. *Flow splitting in supercritical fluid chromatography systems*. US 10183238 B2. 2019.

[3] T. Dourdeville, J. A. Burnett, J. Usowicz, M. Lemelin, **L. O. Tiziani**. *Dispensing needle for a fraction collector*. US 10001463 B2. 2018

[4] J. A. Burnett, J. Usowicz, M. Lemelin, **L. O. Tiziani**, J. Lamoureux, A. Lebeau. *Method of fraction collection for a liquid chromatography system (application)*. Appl. No. 14632049. 2015.

Technical

Proficiency: Robot Planning & Control, Mechatronic System Integration, Embedded Systems

Design: SolidWorks, Siemens NX, ANSYS, EAGLE

Programming: Python, C/C++, ROS (1/2), MATLAB & Simulink, Real-time Linux (Xenomai, Preempt RT), Git, PyQt, Web apps