

Alexander Alexiev

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Education

- M.S. Massachusetts Institute of Technology**, Mechanical Engineering (Robotics) Expected May 2027
 • Supervised by Prof. Sangbae Kim; researching proprioceptive control for dexterous manipulation.
- BASc University of Toronto**, Engineering Science (Robotics and AI) Sept 2020 – May 2025
 • GPA: 3.96/4.0

Publications

- See to Reach, Feel to Grasp: Learning A Blind Grasp Reflex for Anthropomorphic Robotic Hands** Sept 2026
Alexander Alexiev, Tzu-Yuan Lin, Sang Min Kim, Ho Jae Lee, Yonghyeon Lee, Sangbae Kim
 10.48550/arXiv.2609.31323 (Under review, ICRA)
- Real-Time Force Regulation for Whole-Hand Dexterous Grasping** Sept 2026
 Sang Min Kim, **Alexander Alexiev**, Tzu-Yuan Lin, Sangbae Kim, Young Min Kim, Yonghyeon Lee
 10.48550/arXiv.2609.30082 (Under review, ICRA)
- An ingestible robot for autonomously controlled oral delivery of biologics** June 2026
Alexander Alexiev^{*}, Jack Chen^{*}, Karl Werner^{*}, Giovanni Traverso
 Under review, *Nature Mechanical Engineering*
- Learning Reactive Dexterous Grasping via Hierarchical Task-Space RL Planning and Joint-Space QP Control** May 2026
 Ho Jae Lee, Yonghyeon Lee, **Alexander Alexiev**, Tzu-Yuan Lin, Se Hwan Jeon, Sangbae Kim
 Under review, *IEEE Transactions on Robotics*
- An Ingestible Capsule for Luminance-Based Diagnosis of Mesenteric Ischemia** Oct 2025
Alexander Alexiev^{*}, Jack Chen^{*}, Giovanni Traverso
 10.1126/scirobotics.adx1367 (*Science Robotics*)
- Hierarchical Reactive Grasping via Task-Space Velocity Fields and Joint-Space Quadratic Programming** Sept 2025
 Yonghyeon Lee, Tzu-Yuan Lin, **Alexander Alexiev**, Sangbae Kim
 10.48550/arXiv.2509.01044 (ICRA 2026)
- High-Bandwidth Tactile-Reactive Control for Grasp Adjustment** Sept 2025
 Yonghyeon Lee, Tzu-Yuan Lin, **Alexander Alexiev**, Sangbae Kim
 10.48550/arXiv.2509.15876 (ICRA 2026)
- An Implantable System for Opioid Safety** Aug 2024
 Hen-Wei Huang, Peter R. Chai, et al., **Alexander Alexiev**, et al., Giovanni Traverso
 10.1016/j.device.2024.100517 (*Device*, Cell Press)

Patents

- Electrically-Triggered Microactuator Powered by Aluminum-Nickel Nanofilm**
 Patent, WO 2026/076319, April 2026

Research Experience

- Research Assistant in Biomimetic Robotics Laboratory**, Massachusetts Institute of Technology Boston, MA
June 2025 – present
- Investigating performance gains from quasi-direct-drive (QDD) actuators for sim-to-real transfer in reinforcement learning for dexterous manipulation tasks.
 - Created a novel method to grasp objects blindly using only hand proprioception via reinforcement learning and model-based optimal control; *See to Reach, Feel to Grasp*.
 - Developed STM32 firmware for a three-finger tendon-driven hand to decouple joints and enable impedance control at 1,000 Hz over CAN FD.
 - Developed firmware and a machine-learning training pipeline for soft fingertip sensors that estimate force and contact location at 200 Hz using CAN and LCM.

- Undergraduate Researcher in Robot Vision and Learning Lab**, University of Toronto Toronto, ON
June 2022 – Apr 2025
- Developed an undergraduate thesis technique combining non-rigid point-set registration with a graph neural dynamics model for real-time state estimation and prediction of rope and cloth, robust to occlusion and self-overlap.
 - Created an RGB-D computer-vision pipeline with a custom CNN to improve a graph-based task-and-motion-planning algorithm.

- Robotics Research Co-op in Lab for Translational Engineering**, Harvard Medical School / MIT Boston, MA
June 2023 – Jan 2025
- Designed an ingestible robot to deliver mRNA vaccines into stomach tissue, including an ultra-low-power microheater array for igniting reactive metallic nanofilm and an actuator that converts the energy into a penetrating jet of mRNA.
 - Created an ingestible robot with a 10-channel light-sensor array to autonomously diagnose ischemia and gastric bleeding; first author in *Science Robotics*.
 - Developed an embedded C++ algorithm for an implantable device that detects opioid overdose from live IMU data and autonomously administers naloxone; validated detection in a swine terminal study.

Industry Experience

- Machine Learning Research Intern**, Electronic Arts Vancouver, BC (Remote)
May 2021 – Sept 2021
- Led development of a computer-vision model for detecting game-engine animation glitches and non-realistic behavior in FIFA and NHL titles.
 - Designed an autoencoder CNN for anomaly detection on rendered gameplay assets, detecting cloth-animation glitches, missing textures, and irregular human-body configurations.

Student Teams

- Software Co-Lead**, RoboSoccer Humanoid Robotics Team Sept 2022 – Sept 2023
- Ported bipedal motion planning and control from MATLAB to a custom STM32 implementation, increasing the feedback loop to 1,000 Hz; designed a decision-tree-based multi-agent controller for four humanoid robots at RoboCup 2022.
- Embedded Systems and Controls Team**, University of Toronto Formula Racing Sept 2020 – Sept 2022
- Wrote ATmega 2560 firmware for I2C and CAN sensor data and vehicle subsystems including throttle and ABS; designed a cell-level fusing system for a custom 600 V Li-ion battery pack.

Community Involvement

- FIRST Robotics Team 7558** Sept 2018 – present
- Teach modern robotics methods and tools to high-school students. Currently developing a C++ localization library using NVIDIA Isaac Sim, ROS 2, multiple cameras, AprilTags, an extended Kalman filter, and factor graphs.

References

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| Dr. Sangbae Kim , Professor of Mechanical Engineering | Massachusetts Institute of Technology |
| Dr. Giovanni Traverso , Professor of Mechanical Engineering | Massachusetts Institute of Technology |
| Dr. Florian Shkurti , Professor of Computer Science | University of Toronto |