

Roman Ibrahimov

CONTACT INFORMATION

High Performance Robotics Lab (HiPerLab)
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EDUCATION AND PROFESSIONAL DEVELOPMENT

University of California, Berkeley, CA, USA
M.S., Mechanical Engineering, CGPA: 3.7/4.0
Advisors: Prof. Mark Müller

Aug 2023-May 2025

Purdue University, West Lafayette, IN, USA
M.S., Aeronautics and Astronautics, CGPA: 3.89/4.0
Advisors: Prof. Shirley Dyke and Prof. David Cappelleri

Jan 2021-May 2023

- **IEEE RAS Summer School on Multi-Robot Systems**, CTU, Prague, Czechia, 1-5 Aug 2022
Multi-UAV control, perception, localization, and planning
- **DroneCamp**, University of California, ANR, Monterey, California, USA, 27 June - 1 July, 2022
UAV hardware & sensors, mission planning, flight skills, safety & regulations

Skoltech (in collaboration with **MIT**), Moscow, Russia
M.S. with Distinction, Space and Engineering Systems, CGPA: 3.9/4.0
Advisor: Prof. Dzimitry Tsetserukou

Sep 2018-May 2020

ADA University, Baku, Azerbaijan
B.S. Summa Cum Laude, IT and Systems Engineering, CGPA: 3.90/4.0

Sep 2013-May 2018

- **ITMO University**, St. Petersburg, Russia, *Spring 2017*
Exchange Student, Control Systems and Robotics, CGPA: 4.0/4.0
- **Middle East Technical University**, Ankara, Turkey, *Spring 2016*
Exchange Student, Electrical and Electronics Engineering, CGPA: 3.80/4.0

RESEARCH INTERESTS

Planning & Control; Robot design; Wearable Devices; Human-Robot Interaction; Cyber-Physical Systems; Haptics;

PUBLICATIONS

R. Ibrahimov, Teaya Yang, and Mark W. Müller, “Kalman Filter-Based Drift Detection and Mitigation of Visual-Inertial Odometry in UAVs,” *American Control Conference (ACC)*, 2025 (accepted).

Teaya Yang, **R. Ibrahimov**, and Mark W. Müller, “Towards Safe and Efficient Through-the-Canopy Autonomous Fruit Counting with UAVs,” *IEEE International Conference on Robotics and Automation (ICRA)*, 2025 (accepted).

A. Behjat, **R. Ibrahimov**, A. Lenjani, A. Barket, K. Martinus, A. Maghareh, D. Whitaker, I. Bilionis, and S. Dyke, “A Computational Framework for the Evaluation of Resilience in Deep Space Habitat Systems,” *ASME 2022 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference*, St. Louis, Missouri, USA, Aug. 14-17, 2022.

E. Tsykunov, A. Fedoseev, E. Dorzhieva, R. Agishev, **R. Ibrahimov**, D. Vasquez, L. Labazanova, and D. Tsetserukou, “DroneStick: Flying Joystick as a Novel Type of Interface,” *ACM SIGGRAPH Asia 2021 Emerging Technologies*, Virtual, Dec. 14-17, 2021.

E. Karmanova, V. Serpiva, S. Perminov, **R. Ibrahimov**, A. Fedoseev, and D. Tsetserukou, “SwarmPlay: A Swarm of Nano-Quadcopters Playing Tic-tac-toe Board Game against a Human,” *ACM SIGGRAPH 2021 Emerging Technologies*, Virtual, Aug. 9-13, 2021.

R. Ibrahimov, N. Zherdev, and D. Tsetserukou, “DroneLight: Drone Draws in the Air using Long Exposure Light Painting and ML,” *29th IEEE International Conference on Robot & Human Interactive Communication (IEEE RO-MAN 2020)*, Naples, Italy, Aug. 31-Sept. 4, 2020.

E. Tsykunov, R. Agishev, **R. Ibrahimov**, T. Moriyama, L. Labazanova, H. Kajimoto, and D. Tsetserukou “Swarm-Cloak: Landing of Two Micro-Quadrotors on Human Hands Using Wearable Tactile Interface Driven by Light Intensity,” *2020 IEEE Haptics Symposium*, Washington DC, USA, March 28-31, 2020.

R. Ibrahimov, E. Tsykunov, V. Shirokun, A. Somov, and D. Tsetserukou, “DronePick: Object Picking and Delivery Teleoperation with a Drone Controlled by a Tactile Wearable,” *28th IEEE International Conference on Robot & Human Interactive Communication (IEEE RO-MAN 2019)*, New Delhi, India, 2019.

E. Tsykunov*, **R. Ibrahimov***, D. Vasquez, D. Tsetserukou, “SlingDrone: System for Navigation and Interaction with the Environment Using a Single Drone and VR,” *25th ACM Symposium on Virtual Reality Software and Technology (VRST 2019)*, Sydney, Australia, 2019.

*- authors contributed equally to the paper.

E. Tsykunov, R. Agishev, **R. Ibrahimov**, L. Labazanova, T. Moriyama, H. Kajimoto, D. Tsetserukou, “SwarmCloak: Landing of a Swarm of Nano-Quadrotors on Human Arms,” *Int. Conf. on Computer Graphics and Interactive Technologies (ACM SIGGRAPH Asia 2019), Emerging Technologies*, Brisbane, Australia, 2019.

E. Tsykunov, R. Agishev, **R. Ibrahimov**, L. Labazanova, A. Tleugazy, and D. Tsetserukou, “SwarmTouch: Guiding Swarm of Nano-Quadrotors with Impedance Control using Wearable Tactile Interface,” *IEEE Transactions on Haptics*, 2019.

G. Yashin, D. Trinitatova, R. Agishev, **R. Ibrahimov**, and D. Tsetserukou, “AeroVR: Virtual Reality Teleoperation System for the UAV Robotic Manipulator,” *19th IEEE International Conference on Advanced Robotics (ICAR 2019)*, Belo Horizonte, Brazil, 2019.

PROJECT EXPERIENCE

Autonomous Drone Inspection of Caltrans Bridges, UC Berkeley *Aug 2023-present*

- Implemented visual-inertial odometry with OpenVINS, integrating IMU and stereo camera
- Configured and tested hardware, including RealSense D455 for depth imaging, Qualcomm RB5 for onboard computing and Pixracer R15 for flight control
- Managed system communication via the Robot Operating System (ROS)

An inspection robot for Duke Energy Power Lines, Purdue University *May 2022-Aug 2023*

- Implemented Model Predictive Control (MPC) for trajectory tracking along power lines
- Developed line detection algorithms using OpenCV for enhanced visual recognition
- Modeled and simulated robot dynamics
- Configured and tested Argo rover for optimal field deployment and reliability

Resilient Extraterrestrial Habitats, NASA RETH Institute, Purdue University *May 2021-Aug 2023*

- Designed a control-theoretic autonomy framework to support resilient design and operation
- Built automated active learning framework with robots and humans-in-the-loop
- Developed methods for detection and diagnosis of anticipated and unanticipated faults
- Contributed to establishing SmartHabs with autonomous abilities to sense, anticipate and respond

Bio-inspired nano-quadcopter for map building, Purdue University *Sep 2021-May 2022*

- Developed an API on FreeRTOS to read sensor reading on the quadcopter
- Transmitted sensor data to the ROS base station via radio communication
- Collected and processed point cloud data to construct detailed environmental maps
- Applied machine learning techniques to predict the map of the environment

Human-Drone Interaction through a Tactile Wearable, Skoltech *Oct 2018-May 2020*

- Implemented human-drone communication using impedance control and vibrotactile feedback
- Designed a tactile wearable equipped with eccentric rotating mass (ERM) motors for intuitive interaction
- Created a Virtual Reality (VR) application in C# to support teleoperation and aerial manipulation tasks
- Developed remote object manipulation techniques using drones

Balloon Satellite for Testing Solar Cells in High Altitude, Skoltech *Sep 2018-Jan 2019*

- Applied Model-based Systems Engineering principles to ensure mission success
- Constructed a CubeSat featuring an onboard controller, solar cells, storage devices, and GPS tracking
- Gathered and analyzed current, voltage, and temperature (CVT) data from solar cell tests
- Retrieved payload with no damage after landing from 35km maximum altitude

Gas Leak Detecting Mobile Robot for NICA Collider, JINR *Summer 2018*

- Designed autonomous navigation system around elliptical collider
 - Built a mobile robot with an on-board temperature camera
 - Developed Computer Vision (CV) algorithm based on Python for detection nitrogen gas leak from the collider
 - Came up with computer-based user interface for remote monitoring
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WORK EXPERIENCE

Graduate Research Assistant, UC Berkeley, CA, USA *Aug 2023-present*

- Design and test control algorithms for UAV stability and obstacle avoidance in complex environments.
- Optimize data processing workflows, enhancing efficiency and accuracy for real-time inspection feedback.
- Collaborate with interdisciplinary teams to troubleshoot hardware and software challenges, ensuring seamless integration.

Graduate Research Assistant, NASA RETH Institute, IN, USA *May 2021-Aug 2023*

- Developed real-time fault detection algorithms and situational awareness systems to enhance safety and reliability in extreme environments.

- Designed and configured hardware systems, including specialized sensors, actuators, and computational units, to support autonomous operation in space habitats.
- Conducted simulations and tests to validate habitat resilience against environmental and operational disruptions.
- Collaborated with interdisciplinary teams to integrate control-theoretic approaches into habitat design, advancing NASA's SmartHab initiative with enhanced autonomous capabilities.

Teaching Assistant, Purdue University

Jan 2021-May 2022

- CNIT 155 Introduction to Software Development Concepts (in Python)
- Supported course delivery by leading coding labs and exercises, guiding students in foundational Python programming and problem-solving.
- Conducted hands-on lab sessions, helping students implement concepts through coding exercises and real-world applications.
- Held office hours to address individual student questions, clarify complex topics, and provide assignment assistance.
- Created and evaluated coding assignments, offering constructive feedback to enhance students' programming skills and understanding of software development principles.

Intern, Universal Robots, Moscow, Russia

Summer 2019

- Assisted in research and development for Human-Robot Collaboration (HRC) applications involving quadcopters to enhance interaction and safety.
- Participated in designing and testing control strategies to improve quadcopter responsiveness and collaboration capabilities.
- Supported hardware configuration and troubleshooting to ensure seamless integration of HRC functionalities.
- Documented findings and presented insights to the team, contributing to advancements in HRC applications.

Intern, Azercosmos OJSCo, Baku, Azerbaijan

Summer 2017

- Supported the Ground Control Department in monitoring and maintaining satellite communication systems.
- Assisted with network configuration and troubleshooting to ensure stable connectivity and optimal system performance.
- Gained experience in analyzing and managing data flow within ground control networks.
- Documented operational procedures and reported on system performance, contributing to improved workflow efficiency.

HONORS AND AWARDS

Purdue University Poster Symposium Best Poster Award \$750

April 2022

Skolkovo Foundation Full Graduate Scholarship

2018-2020

ACM SIGGRAPH Asia Best Demonstration Award

November 2019

Skolkovo Presidential Scholarship

November 2019

Skolkovo Presidential Travel Award, \$5000

November 2019

Skolkovo Presidential Travel Award, \$4500

November 2019

President's List of Honor, ADA University

2014-2017

Erasmus+ Exchange Scholarship, METU

Spring 2016

FameLab World Finalist, Cheltenham, the UK

June 2015

1st place, Microsoft ImagineCup Competition, Baku, Azerbaijan

May 2015

4th place, International Rudolf Ortway Competition in Physics, Hungary

Dec 2014

REVIEWER FOR CONFERENCE AND JOURNALS

IEEE Robotics and Automation Letters (RA-L) 2024, RA-L 2023, RA-L 2022, IEEE International Conference on Robotics and Automation (ICRA) 2024, ICRA 2023, ICRA 2021, ICRA 2020; ACM Conference on Human Factors in Computing Systems (CHI) 2020; Virtual Reality & Intelligent Hardware Journal 2020;

TECHNICAL SKILLS

Programming: C/C++, Java, Python, MATLAB/Simulink, LabVIEW, L^AT_EX

Robotics: Robot Operating System (ROS), ROS2, Gazebo, RViz, Unity

MCUs: Qualcomm RB5, myRIO, Arduino, Libelium

Mechanical: CAD (SolidWorks), 3D Printing, soldering, laser/plasma cutting