

# TOHID KARGAR TASOOJI

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## Summary or Objective

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I am a dedicated researcher and engineer specializing in control systems, robotics, and autonomous vehicle. I develop event-triggered cooperative control, secure localization, and resilient coordination strategies for multi-robot networks in uncertain and adversarial environments. My research integrates advanced state estimation, learning-enabled control barrier functions, and motion planning, bridging theory, simulation, and real-world experimentation. I have a strong publication record in top-tier journals and conferences, with contributions to IEEE Transactions, ICRA, and IROS, and have led projects combining multi-robot coordination, UAV-assisted coverage, and autonomous vehicular systems. I also have applied experience in industry, developing algorithms for vehicle dynamics and autonomous driving at General Motors.

## Education

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### University of Alberta

Sep 2018 – Dec 2022

*Ph.D. Control and Robotic Engineering*

*Edmonton, Alberta*

- Thesis: Event-triggered cooperative control and localization in multi-robot systems: theory and experiments

### Ozyegin University

Sep 2015 – June 2018

*M.Sc. Electrical Engineering*

*Istanbul, Turkey*

- Thesis: Energy consumption modeling and optimization of speed profile for plug-in electric vehicles

### Urmia University of Technology

Jan 2011 - Mar 2015

*B.Sc. Electrical and Electronics Engineering*

*Urmia, Iran*

## Research Interests

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Robotics and Autonomous Systems; Multi-Robot Control, Localization, and Coordination; State Estimation and Motion Planning; Cyber-Physical and Wireless Networked Systems; Fault-Tolerant Control; Automated and Electrified Vehicles; Reinforcement Learning and Large Language Models.

## Experience

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### University of Georgia

Aug 2024 – Present

*Post Doctoral Research Fellow in Computer Science and Robotics*

*Athens, USA*

- Developing algorithms to improve the robustness of multi-robot localization in sparse/dense network and adversarial environment
- Conducted research on cooperative perception for connected and automated vehicles
- Conducted research on communication-aware multi-robot coverage control
- Conducted research on learning-enabled control barrier functions for resilient multi-robot navigation in uncertain adversarial environments
- Conducted research on multi-robot active target tracking with UAVs via voronoi-based coverage and altitude optimization
- Developed Cubature Kalman Filter for multi-robot cooperative localization in non-smooth maneuvers
- Developed coordination strategies, such as consensus and formation control, for multi-robot systems with localization uncertainty
- Developed framework for multirobot target search in unknown and adversarial environments using adaptive communication-aware, learning-based distributed model predictive control
- Developed a real-time, decentralized control framework for safe and adaptive multi-robot formation in dynamic, uncertain environments, integrating safety, connectivity, and goal-reaching in a structured decision-making hierarchy
- Develop hierarchical LLMs in-the-loop optimization for real-time multi-robot target tracking under unknown Hazards
- Led Ph.D. students and interns in projects on multi-robot systems, including optimal charging station allocation, distributed connectivity restoration, and cooperative localization under sparse and noisy sensing conditions.

### Toronto Metropolitan University

Feb 2024 – Aug 2024

*Post Doctoral Research Fellow in Robotics*

*Toronto, Canada*

- Designed event-based Nonlinear Model Predictive Control (NMPC) algorithms for multi-robot systems transporting cable-suspended payloads.
- Designed energy-efficient and obstacle-aware path-planning algorithms using event-based triggers to minimize communication overhead.
- Integrated ROS and Gazebo for simulation and real-time testing of cooperative multi-robot systems.

## General Motors

Jan 2023 – Jan 2024

*Algorithm Design and Development Engineer*

*Markham, Canada*

- Developed diagnostics and controls for vehicle dynamics systems (eLSD, eLocker, and Active Downforce).
- Interpreted feature requirements, developed physics, algorithms, and analyzed vehicle dynamic conditions.
- Developed Model in the Loop (MIL) test cases using Simulink for design, calibration, and performance analysis.
- Created automated test cases in Software in the Loop (SIL)/Hardware in the Loop (HIL) environment to validate Integrated Chassis Control Module (ICCM) controller.
- Contributed to the migration from VIP architecture to Software Defined Vehicle (SDV) architecture for various automotive features.
- Estimated communication latency between high-level control (ICCM or EBCM) and low-level control (DCM) for eLSD feature based on SDV architecture.
- Reduced Cyclomatic complexity for different software components to ensure software quality.

## General Motors

June 2022 – Feb 2023

*ADAS and Autonomous Software Engineering Intern*

*Markham, Canada*

- Developed a tool for the automatic generation of driving routes, optimizing road coverage while minimizing miles.
- Created Python algorithms for route generation, maximizing road coverage based on map data for North America.
- Built a Linux version of the MapApp and integrated it into the SIL environment in coordination with the HDLM team.
- Collaborated with the analytic team to optimize routes for areas where Super Cruise faces challenges in the engaged state.
- Implemented algorithms to find nearest road segments using Rtree/minimum bounding box approach and a map database (SQLite format) based on given GPS coordinates.
- Developed and tested routes in the Simian environment using GPS CSV files, gaining experience in data structures and shortest path algorithms.

## University of Alberta

Sep 2018 – Dec 2022

*Advanced Control Systems Lab*

*Alberta, Canada*

See also my projects in YouTube page.

- **Project:** Extended Kalman Filter (EKF)-based Cooperative Localization for Mobile Robots
- **Description:** Implemented an EKF-based algorithm in ROS (Python and C++), fusing odometry data and vision-based sensor measurements. Enabled robots to localize themselves while minimizing communication exchange and energy consumption in the presence of time delays and cyber attacks. conducted experiments to validate localization accuracy.
- **Project:** Event-Triggered Consensus Control for Mobile Robots
- **Description:** Developed an event-triggered consensus control in ROS (using Python and C++), utilizing cooperative localization. Robots jointly achieved consensus while considering position estimates and addressing potential DoS attacks. Evaluated performance in terms of consensus, communication rate, and accuracy.
- **Project:** Secure Control Scheme for Connected Vehicles (CAVs)
- **Description:** Designed a secure control scheme for a platoon of CAVs, considering cyber attacks. Implemented safety measures to ensure robust control and performance in the presence of potential threats.
- **Project:** Autonomous Row Following with PID Control
- **Description:** Implemented a PID controller to generate a target angular rate for mobile robots. Used a depth camera's scanned point cloud for row following, enabling precise navigation to the center of the row.

## Ozyegin University

Sept 2015 - Aug 2018

*Research Associate*

*Istanbul, Turkey*

- **Project Description:** Topography-Based Predictive Energy Management for Electric Vehicles, funded by TÜBİTAK and collaborated with Hexagon Studio
- Developed a cruise control system for electric vehicles using a model predictive controller (MPC) and PID controller.
- Conducted energy consumption modeling for electric vehicles and calculated consumption based on given speed profiles.
- Tested the MPC in Hardware in the Loop emulation and performed Monte Carlo method testing on various routes.

## ARTICLES

See also my Google Scholar page.

## Accepted Papers

- **T. Kargar Tasooji** and R. Parasuraman, "Distributed Fault-Tolerant Multi-Robot Cooperative Localization in Adversarial Environments", Accepted to the IEEE International Conference on Intelligent Robots and Systems (IROS 2025), arXiv preprint arXiv:2507.06750, Jul. 2025.
- S. Nistane, **T. Kargar Tasooji** and R. Parasuraman, "H-Cov: Multi-UAV Sensor Coverage with Altitude Optimization for Target Tracking", Aerial Robotics Workshop, IEEE International Conference on Robotics and Automation (ICRA), May 2025.

## Journal Articles

- **T. Kargar Tasooji**, S. Khodadadi and H. J. Marquez, "Event-Based Secure Consensus Control for Multirobot Systems With Cooperative Localization Against DoS Attacks," IEEE/ASME Transactions on Mechatronics, doi: 10.1109/TMECH.2023.3270819.
- **T. Kargar Tasooji** and H. J. Marquez, "Event-Triggered Consensus Control for Multi-Robot Systems with Cooperative Localization," IEEE Trans. Ind. Electron., July 2022, doi: 10.1109/TIE.2022.3192673.
- **T. Kargar Tasooji** and H. J. Marquez, "Cooperative Localization in Mobile Robots Using Event-Triggered Mechanism: Theory and Experiments," IEEE Trans. Autom. Sci. Eng., vol. 19, no. 4, pp. 3246-3258, 2022.
- **T. Kargar Tasooji** and H. J. Marquez, "Decentralized Event-Triggered Cooperative Localization in Multirobot Systems Under Random Delays: With/Without Time-stamps Mechanism," IEEE/ASME Trans. Mechatronics, Sept. 2022, doi: 10.1109/TMECH.2022.3203439.
- **T. Kargar Tasooji** and H. J. Marquez, "A Secure Decentralized Event-Triggered Cooperative Localization in Multi-Robot Systems Under Cyber Attack," IEEE Access, vol. 10, pp. 128101-128121, 2022, doi: 10.1109/ACCESS.2022.3227076.
- S. Khodadadi, **T. Kargar Tasooji** and H. J. Marquez, "Observer-Based Secure Control for Vehicular Platooning Under DoS Attacks," IEEE Access, vol. 11, pp. 20542-20552, 2023, doi: 10.1109/ACCESS.2023.3250398.

## Submitted Manuscripts

- **T. Kargar Tasooji** and R. Parasuraman, "Hybrid Framework for Multi-Robot Target Search in Unknown and Adversarial Environments," Submitted to the International Conference on Robotics and Automation (ICRA 2026).
- **T. Kargar Tasooji** and R. Parasuraman, "Safe and Adaptive Multi-Robot Formation Control via Composed CBF-QP in the Presence of Dynamic and Uncertain Obstacles," Submitted to the International Conference on Robotics and Automation (ICRA 2026).
- **T. Kargar Tasooji** and R. Parasuraman, "Decentralized Learning-Enabled Control Barrier Functions for Resilient Multi-Robot Navigation in Uncertain Adversarial Environments", Submitted to the International Conference on Robotics and Automation (ICRA 2026).
- **T. Kargar Tasooji** and R. Parasuraman, "Distributed Adaptive Event-Based Cubature Kalman Filter for Multi-Robot Cooperative Localization", Submitted to the International Conference on Robotics and Automation (ICRA 2026).
- **T. Kargar Tasooji** and R. Parasuraman, "Multi-Robot Consensus and Coordination with Localization Uncertainty ", Submitted to the International Conference on Robotics and Automation (ICRA 2026).
- **T. Kargar Tasooji**, Sakineh Khodadadi, Guangjun Liu, "Event-Triggered Nonlinear Model Predictive Control for Cooperative Cable-Suspended Payload Transportation with Multi-Quadrotors," Submitted to the International Conference on Robotics and Automation (ICRA 2026).
- S. Nistane, **T. Kargar Tasooji** and R. Parasuraman, "Multi-Robot Active Target Tracking with UAVs via Voronoi-Based Coverage and Altitude Optimization", Submitted to the International Conference on Robotics and Automation (ICRA 2026).
- A. Sagale, **T. Kargar Tasooji** and R. Parasuraman, "DCL-Sparse: Distributed Range-only Cooperative Localization of Multi-Robots in Sparse and Noisy Sensing Graphs", Submitted to the International Conference on Robotics and Automation (ICRA 2026).

## Conference Papers

- M. A. Gozukucuk, T. Akdogan, W. Hussain, **T. Kargar Tasooji**, M. Shahin, M. Celik, H. F. Ugurdag, "Design and Simulation of an Optimal Energy Management Strategy for Plug-In Electric Vehicles," 2018 6th CEIT, pp. 1-6, 2018, doi: 10.1109/CEIT.2018.8751923.
- **T. Kargar Tasooji**, O. Bebek, and B. Ugurlu, "A Robust Torque Controller for Series Elastic Actuators: Model Predictive Control with a Disturbance Observer," Turkish Automatic Control Conference, 2017.
- **T. Kargar Tasooji**, A. Mostafazadeh and O. Usta, "Model predictive controller as a robust algorithm for maximum power point tracking," 2017 10th ELECO, pp. 175-179, 2017.
- A. Mostafazadeh, **T. Kargar Tasooji**, M. Sahin and O. Usta, "Voltage control of PV-FC-battery-wind turbine for stand-alone hybrid system based on fuzzy logic controller," 2017 10th ELECO, pp. 170-174, 2017.

## Thesis

- **T. Kargar Tasooji**, "Cooperative Localization and Control In Multi-Robot Systems With Event-Triggered Mechanism: Theory and Experiments", University of Alberta, <https://doi.org/10.7939/r3-t0g9-ch09>, 2022
- **T. Kargar Tasooji**, "Energy consumption modeling and optimization of speed profile for plug-in electric vehicles", Ozyegin University, 2015

## Teaching Experience

### University of Alberta

Jan 2019 – Dec 2022

#### Teaching Assistant

Edmonton, Canada

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|---|-------------|
| • ECE 209 - Fundamentals of Electrical Engineering, U of A, Alberta, Canada | Winter 2022 |
| • ECE 560 - Modern Control Theory , U of A, Alberta, Canada                 | Fall 2021   |
| • ECE 460 - Control Systems II, U of A, Alberta, Canada                     | Winter 2021 |
| • ECE 560 - Modern Control Theory , U of A, Alberta, Canada                 | Fall 2020   |
| • ECE 210 - Introduction to Digital Logic Design, U of A, Alberta, Canada   | Fall 2020   |
| • ECE 303 - Analog Electronics, U of A, Alberta, Canada                     | Winter 2020 |
| • ECE 304 - Digital Electronics, U of A, Alberta, Canada                    | Fall 2019   |
| • ECE 203 - Electrical Circuits II, U of A, Alberta, Canada—                | Winter 2019 |
| • ECE 209 - Fundamentals of Electrical Engineering, U of A, Alberta, Canada | Winter 2019 |

## Honors, Awards, and Achievements

- Elevated to **IEEE Senior Member**, May 2025
- Received the **Natural Sciences and Engineering Research Council of Canada (NSERC)** Research Fellowship.
- Received the **Scientific and Technological Research Council of Türkiye (TÜBİTAK)** Research Fellowship.
- Received the **Natural Sciences and Engineering Research Council of Canada (NSERC)** Post-doctoral Research Fellowship.
- Received multiple recognitions for **outstanding performance** as an employee at General Motors
- Awarded **Best Student Excellence in graduate courses** like Advanced Control, Mechatronics, Modern Control

## Technical Skills

**Control Systems:** Model Predictive Control (MPC), PID Control, Event-Triggered Control, Nonlinear Control

**Robotics:** Multi-Robot Localization, Path Planning, SLAM, Autonomous Navigation

**Software Development:** MATLAB/Simulink, Python, C/C++, ROS, Git, Jenkins, Docker, SIL/HIL

**Machine Learning & AI:** Deep Learning, Reinforcement Learning, Sensor Fusion

**Industry Tools:** CarSim, INCA, dSpace, AutoVal, CAN, Ethernet, AUTOSAR, Real-Time Operating Systems (RTOS)

## Reviewing Activities

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- IEEE Transactions on Automation Science and Engineering
- IEEE/ASME Transactions on Mechatronics
- IEEE Transactions on Industrial Informatics
- IEEE Robotics and Automation Letters
- International Journal of Robust and Nonlinear Control
- IEEE Conference on Control Technology and Applications
- IEEE Transactions on Systems, Man and Cybernetics: Systems
- IEEE Transactions on Industrial Electronics
- IEEE Transactions on Robotics
- IEEE Internet of Things Journal
- International Journal of Robotics Research
- IEEE International Conference on Intelligent Robots and Systems (IROS 2025)
- IEEE Transactions on Cybernetics
- International Conference on Robotics and Automation (ICRA)
- International Symposium on Distributed Autonomous Robotic Systems

## Invited Talks, Seminars, Workshops

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- Invited Session Chair, Technical Paper Session, IEEE International Conference on Robotics and Automation (ICRA), 2025
- Invited for a site visit at Beep Inc., a leading provider of autonomous and connected vehicle technologies.
- Presented "Advanced Control, Localization, and Energy Management Techniques for Multi-Agent Systems," Invited Talk, Ohio State University, Aug 2024.
- Presented "Automation Environment for Validation of Software," Invited Talk, General Motors, Jul 2023.
- Presented "Distributed LQG Consensus Control of Networked Multi-Agent Systems Using Event-Triggered Communication Mechanism," 2nd Annual Symposium Program, Autonomous Systems Initiative, Jun 2021.
- Presented "Decentralized Event-Triggered Cooperative Localization in Multi-Robot Systems," Methodologies and Tools for Autonomous Systems Workshop, Aug 2020.