Longhao Qian — CV

Personal information

Name	Longhao Qian (潜龙昊)
Highest degree	Ph.D.
Current location	Toronto, Canada
Profiles	LinkedIn: linkedin.com/in/longhao-qian-uoft-postdoc GitHub: github.com/LonghaoQian Google Scholar: scholar.google.ca/citations?user=p2oGLVYAAAAJ
Email	longhao.qian@mail.utoronto.ca
WeChat	werewolf-1

Summary

I received my Ph.D. in aerospace engineering from the University of Toronto, Canada, and I am currently a Postdoctoral Researcher at the University of Toronto, focusing on aerial embodied intelligence for drones and the engineering deployment of AI algorithms. My core expertise spans reinforcement learning (PPO/MADDPG), physics-informed neural networks (PINNs), and multi-vehicle cooperative control, and I have full-stack R&D experience from algorithm design to hardware deployment, including real-time neural-network inference on NVIDIA Jetson Orin, Pixhawk flight-controller integration, and CAN-bus actuator control. I have led several complete projects through to deployment and validation: achieving 15 cm-level tracking accuracy in high-speed flight at 8–12 m/s, and proposing a novel scheduling algorithm for UWB chips that reduced system power consumption by 30%. I previously worked as a chip software engineer at Huawei Technologies Co., Ltd., where I became familiar with the R&D processes and coding standards of a large enterprise, and earned Huawei's Professional-Level C++ Software Competency Certification and the HiSilicon Quality Star Award.

I have solid team-leadership experience. At the University of Toronto, I have led five R&D teams of 2–6 Ph.D., master's, and undergraduate students, responsible for research planning, defining technical roadmaps, task allocation, and quality control of results, and I have guided these teams to publish in top journals such as JGCD and Science China and at top conferences such as CDC and AIAA SciTech. As lead of the control and visual-navigation subsystems for the A2RL international autonomous drone racing competition, I led the team to 7th place among 22 teams. At Huawei, I served as project lead and software Committer, led the team to complete driver development for a low-power ranging chip, and improved the team's overall capability through regular technical training. I am skilled at coordinating cross-disciplinary R&D teams and efficiently driving the complete R&D cycle from solution design to engineering validation.

Work and project experience

Postdoctoral Researcher — University of Toronto, Institute for Aerospace Studies

2023/04 – present · www.utias.utoronto.ca · Lab: Flight Systems and Control (FSC) Lab · 4925 Dufferin St, North York, ON M3H 5T6, Canada

Supervisor: Dr. Hugh H.T. Liu — Fellow of the Canadian Academy of Engineering; Professor and Ph.D. supervisor at the University of Toronto Institute for Aerospace Studies; Director of the University of Toronto Centre for Aerial Robotics Research and Education.

Work achievements:

Project: Aerial Embodied Intelligence and Vision-Language Models (VLMs) on a Drone-Manipulator Platform

2025/10 – present

- Led a four-person team (3 Ph.D. students, 1 master's student) to design interactive grasping and trajectory-tracking algorithms for a drone-manipulator platform. I was personally responsible for the L1 adaptive control design, the debugging and calibration of the manipulator arm, and the overall system architecture, including the communication links and the software system design. By analyzing the multibody dynamics equations of the manipulator platform, proposed an aerial embodied intelligence framework based on L1 adaptive control, filling the gap in theoretical stability proofs for aerial intelligent manipulator platforms. Achieved an average dynamic object-manipulation error of 3–4 cm in flight experiments — the highest accuracy for object manipulation with aerial serial manipulators reported in the existing literature. Implemented VLM capabilities for the aerial embodied platform based on Qwen2.5-VL-7B (Tongyi Qianwen), enabling the platform to autonomously recognize target objects and invoke the low-level visual localization algorithm for pre-grasp positioning; implemented natural-language control of the drone based on Qwen2.5-7B.
- To address parameter uncertainties in the flight system — such as the effects of aerodynamic drag and propeller downwash (the downward airflow generated by the rotors) on flight — used Proximal Policy Optimization (PPO) reinforcement learning combined with domain randomization to narrow the Sim2Real (simulation-to-reality transfer) gap. Trained the PPO control-correction algorithm in NVIDIA Isaac Sim 6.0 and Isaac Lab 3.0.
- Deployed the embodied-intelligence control framework on an NVIDIA Jetson Orin onboard computer, with high-speed, low-latency UDP communication over Ethernet between the onboard computer and the flight control unit. Achieved, for the first time, direct control of the drone's propellers and the manipulator by the NVIDIA Jetson Orin at 400 Hz, greatly improving manipulation and tracking accuracy.
- Using XM430-W350 joint actuators, designed FOC (field-oriented control) current-loop control, improving torque actuation accuracy by about 20% in torque-control mode and laying the foundation for improving overall object-manipulation accuracy.
- Using a RealSense depth camera and running YOLOv8 with Ultralytics, combined RGB object detection with depth information to achieve autonomous target recognition and localization, with centimeter-level localization accuracy for static targets.
- Deployed the Qwen2.5-VL-7B large model locally on a ground-station computer equipped with an RTX 4070. The drone connects to the ground control station over a P2P network, which obtains the motion states of the drone and the manipulator in real time. By recognizing objects in camera images and invoking the precise localization results of the RealSense depth-camera module, the large model enables a fully autonomous environment-interaction system for the aerial embodied platform. The large model invokes the embodied control framework proposed in this research to command the drone to grasp and place objects, realizing a closed-loop physical-AI expert system centered on a large model.

Project: Trustworthy AI Control Framework Based on Physics-Informed Neural Networks (PINNs)

2025/08 – 2026/03

- Led a two-person team (1 Ph.D. student, 1 master's student) and proposed a nonlinear control training method based on physics-informed neural networks (PINNs) that enables neural networks to automatically generate robust control algorithms from a system's multibody dynamics equations without any training dataset, enabling rapid generation of control schemes for complex systems. Compared with conventional machine-learning control, the PINN-generated controllers strictly satisfy the theoretical requirements of control stability, yielding reliable neural-network-based control.
- Through differential geometry, combined PINNs with Riemannian manifold theory to achieve singularity-free control of the spatial attitude of drones and robots. Combined with contraction analysis control theory, transformed the robust control problem into the solution of a partial differential equation (PDE), and then solved the PDE with PINNs to obtain control networks with stability guarantees.
- Proposed, for the first time, a robust control theory combining PINNs with Riemannian manifolds (Robust Control Contraction Metrics, RCCM), which still guarantees control accuracy in the presence of unknown external disturbances and parameter uncertainties.
- The PINN-based AI control framework proposed in this research can be widely applied to the control of unmanned systems and embodied intelligence.

- Results have been accepted by the top international control conference, the IEEE Conference on Decision and Control (CDC 2026), and by the AIAA 2027 SciTech Forum: “Neural Robust Control on Lie Groups Using Contraction Methods” (CDC 2026) and “Contraction-based Neural Control for Cooperative Aerial Payload Transportation with Variable-length Cables” (AIAA SciTech 2027).

Project: Cooperative UWB and LiDAR Drone Navigation with Reinforcement Learning (PPO)

2025/08 – 2026/03

- Led a two-person team (1 Ph.D. student, 1 master’s student) and proposed a localization and navigation algorithm for drone formation flight based on the observability Gramian (a mathematical tool for measuring whether a system’s states can be accurately estimated).
- Unlike conventional formation flight, this method only requires the leader to provide absolute position measurements via GPS or LiDAR SLAM; the followers rely only on their onboard IMU (inertial measurement unit) and a single range measurement from an ultra-wideband (UWB) system to estimate their 3D position relative to the leader, enabling close-proximity formation flight.
- Theoretically analyzed the relationship between the observability Gramian and the follower’s localization error, and proposed an optimal leader–follower trajectory planning scheme: the leader and the follower move along specific trajectories so that the follower’s Kalman filter can use these trajectories to avoid observability singularities and achieve the minimum estimation error, filling a research gap on this problem. Results were published in the top international aerospace journal, the Journal of Guidance, Control, and Dynamics (JGCD): “Observability-aware control for quadrotor formation flight with range-only measurement” (2026).
- Building on this theoretical scheme, developed a LiDAR-SLAM-based localization solution for the leader, enabling autonomous flight in GPS-denied environments.
- Using Proximal Policy Optimization (PPO) reinforcement learning with the observability Gramian as part of the reward function, built a large-scale parallel reinforcement-learning training framework in NVIDIA Isaac Lab to obtain a reinforcement-learning formation-flight policy. The PPO-generated planning solves the difficulty that the observability-Gramian-based planning problem in the JGCD paper is hard to solve in real time, enabling the practical engineering deployment of this formation-flight scheme.

Project: Control of Aerial Slung-Load Manipulation Robots with Reinforcement Learning and Physics-Informed Neural Networks

2025/04 – 2026/06

- Led a six-person team (3 Ph.D. students, 2 master’s students, 1 undergraduate) researching modeling, flight control, and trajectory planning algorithms for aerial slung-load manipulation robots based on reinforcement learning and physics-informed neural networks.
- Proposed a nonlinear control training framework based on physics-informed neural networks (PINNs) that autonomously trains fault-tolerant control algorithms according to the stability principles of automatic control and, combined with the principle of robust disturbance observers, achieved for the first time multi-drone cooperative control of aerial slung-load manipulation robots under strong external disturbances.
- Used Proximal Policy Optimization (PPO) reinforcement learning combined with domain randomization to narrow the Sim2Real (simulation-to-reality transfer) gap. Trained a PPO control-correction algorithm in NVIDIA Isaac Sim, reducing the manipulation errors caused by thrust instability, modeling errors, and airflow disturbances in the real system.
- Combining PINNs with PPO control, deployed the neural networks on an NVIDIA Jetson Orin onboard computer using C++ and PyTorch, achieving for the first time PINN-based multi-drone cooperative control of aerial slung-load manipulation robots on a drone system.
- Implemented a real-time payload-cable manipulation system based on CubeMars AK40-10 joint motors and a CAN communication system, and validated the proposed control algorithms on a quadrotor flight platform.
- The results are currently under review: “A Robust Neural Control Design for Multi-drone Slung Payload Manipulation with Control Contraction Metrics” (arXiv:2510.01489), “Robust Anti-windup Tracking Control For A Pair of Quadrotors Carrying A Rigid-body Payload With Variable-Length Cable” (Automatica), and “Robust Neural Contraction Slung Load Manipulation With Active Cable Length Control” (JGCD).

Project: Reinforcement Learning for Drone Territory Security and Counter-UAV Interception

2024/09 – present

- Led a three-person team (1 master's student, 2 undergraduates) to design autonomous territory-defense interception algorithms for drones using reinforcement learning. Relying only on radio angle-of-arrival measurements of intruding drones, the algorithm plans the optimal task allocation and flight trajectories of the defending drones in real time, achieving autonomous swarm defense and interception.
- Proposed an active localization and position-estimation strategy for illegally intruding drones based on MADDPG (Multi-Agent Deep Deterministic Policy Gradient). Assuming that the defending drones carry small onboard radars, trained optimal interception paths that maximize radar velocity-measurement and localization accuracy, improving the interception success rate. See "Investigating Multi-UAV Territory Guarding Using Cooperative-Competitive Reinforcement Learning" (AIAA SciTech 2026).
- Building on that work, proposed an improved HA-RMAPPO-based reinforcement-learning scheme for drone-swarm territory defense, which uses measurements of the intruding drone's radio return signals to achieve passive filtering and localization of illegally intruding drones. The scheme is suitable for rapid localization and interception of intruding drones by swarms of small, low-cost drones.
- Building on conventional HA-RMAPPO, proposed an RNN-based training framework that, compared with an MLP architecture, improves the success rate of the final interception policy during training on the localization-and-interception problem. The final results were published in Science China Technological Sciences, a CAS Zone 1 top journal: "Hybrid reinforcement learning control for UAV territory guarding with cooperative angle-of-arrival localization" (2026).

Project: Drone-Based Aerial Security System with 5G and AI Edge Computing

2023/05 – 2026/03

- The project was funded by the Natural Sciences and Engineering Research Council of Canada (NSERC) and Canada's Innovation for Defence Excellence and Security (IDEaS) program, with total funding of C$1.54 million (approx. RMB 7.5 million), conducting innovative theoretical and engineering research for intelligent air transportation, aerial security, and the 5G Internet of Things in Canada.
- Proposed flight control algorithms and energy-optimal path planning methods for drones carrying onboard 5G base stations; the results were published at the WF-IoT 2023 and WF-IoT 2024 international conferences: "Robust Stabilization of a Quadrotor as a 5G Access Point Using Acceleration Feedback" and "Energy Aware Planning of A Quadrotor With 5G Access Point in Disaster Response".
- Proposed a genetic-algorithm-based flight path planning algorithm for drone scanning surveillance of designated areas, achieving the maximum scanned area with the minimum battery consumption. The result was published in Science China Information Sciences, a CAS Zone 1 top journal: "A path planning algorithm for a crop monitoring fixed-wing unmanned aerial system" (2024).
- Proposed a YOLOv8-based algorithm for detecting ground intruders / illegal drone operators and planning flight trajectories; combined with "Autonomous Drone Operator Localization Using UAVs With Reinforcement Learning" (IEEE Smart World Congress 2025), achieved automatic detection of ground intruders on a quadrotor flight platform.

Project: 2025 A2RL Abu Dhabi Autonomous Drone Racing

2024/09 – 2025/04

- Represented the University of Toronto in the 2025 A2RL (Abu Dhabi Autonomous Racing League) autonomous drone racing competition, serving as lead of the drone control system and the visual-navigation subsystem. The competition required racing flight using only a monocular camera, with purely vision-based localization and navigation.
- As a first-time team competing alongside professional teams, placed 7th overall (out of 22 teams) and won a US$10,000 prize.
- Built a data-driven, high-fidelity dynamics model of the racing drone. With this model, the tracking error of model predictive control (MPC) was reduced by 20%; during high-speed flight at 8–12 m/s, the drone's tracking accuracy was maintained at about 15 cm.
- Contributed to a visual-navigation dataset generation system based on 3D Gaussian Splatting (3DGS). Used 3DGS to build 3D models of the flight scene and, combined with the geometric positions of feature points, rapidly generated high-accuracy YOLO training sets for visual navigation.
- Worked with the team to implement a purely vision-based dynamic flight localization system based on visual odometry, the IMU, and obstacle-feature localization, with a localization accuracy of about 0.2–0.5 m. Completed all required flight tasks in the competition (only 8 of the 22 participating teams completed all flight tasks).

Chip Software Engineer — Huawei Technologies Co., Ltd.

2021/06 – 2023/04 · Job grade: 16 · Huawei Shanghai Research Center · Huawei Shanghai Research Institute, 2222 Xinjinqiao Road, Jinqiao Economic and Technological Development Zone, Shanghai, China

Work achievements:

- As project lead, led the team in developing the drivers for a next-generation low-power short-range ranging and communication chip and the accompanying smart-home solutions. Outstanding work results and team development; received an A rating in the 2022 annual performance evaluation (top 20% of all staff).
- Outstanding performance in software programming and software standards: obtained Huawei's Professional-Level C++ Software Competency Certification in 2022, and in the same year obtained software Committer qualification, responsible for the team's code-quality control and code-architecture improvement.
- In chip software R&D, led the team in developing scheduling and positioning algorithms for a high-precision short-range ranging chip in C and C++. Combined with the new chip architecture, the novel scheduling algorithm saves 30% of the power consumption of conventional UWB systems. As part of Huawei's smart-home solution, the chip was a key development project of the department.
- In chip software-in-the-loop (SIL) simulation, proposed a fast chip-driver verification method. By simulating chip interrupts, the method reduced software system verification time from 40 minutes to 44 seconds, greatly improving code development efficiency and laying the software foundation for later verification of complex logic. This improvement received the 2022 Huawei HiSilicon Quality Star Award.
- In indoor positioning algorithms, participated in developing an AI-based high-precision positioning method for wearable devices. The method uses a neural network to build a signal multipath-scattering model, effectively distinguishing direct signals from interfering reflected signals and improving ranging accuracy by about 10%.
- Implemented a Wi-Fi-based positioning algorithm with decimeter-level positioning accuracy, which became a strong auxiliary means for the smart-home system.
- In team development, regularly organized team training and technical exchanges, greatly improving the team's skills in C, C++, machine learning, and CMake. Contributed multiple high-quality tutorials to the company's knowledge forum, improving the overall technical strength of the project group.

Ph.D. — University of Toronto, Institute for Aerospace Studies

2016/09 – 2021/03 · www.utias.utoronto.ca · Lab: Flight Systems and Control (FSC) Lab · 4925 Dufferin St, North York, ON M3H 5T6, Canada

Supervisor: Dr. Hugh H.T. Liu — Fellow of the Canadian Academy of Engineering; Professor and Ph.D. supervisor at the University of Toronto Institute for Aerospace Studies; Director of the University of Toronto Centre for Aerial Robotics Research and Education.

Work achievements:

- Conducted research on the control theory and engineering implementation of autonomous drone transportation systems. For applications in which multiple drones carry a tethered payload, proposed a complete set of nonlinear control methods based on multibody dynamics, achieved cooperative payload transportation with multiple drones, and built an experimental platform to validate the engineering feasibility of the approach, providing a solution to the control challenges of cooperative drone transportation in future smart cities.
- The project was jointly funded by the Natural Sciences and Engineering Research Council of Canada (NSERC) and Drone Delivery Canada, with total funding of C$640,000 (approx. RMB 3.2 million).
- The outstanding doctoral research was supported by full scholarships from the University of Toronto and the Government of Ontario: the Ontario Trillium Scholarship (awarded to only 75 recipients across Ontario), totaling C$160,000 (approx. RMB 820,000).
- On the theoretical side, proposed a nonlinear control system based on the Lyapunov method and proved that it guarantees stable transportation of the tethered payload in the presence of unknown disturbances, providing a technical foundation for safe payload transportation in adverse weather. The results were published in the top international journals Journal of Guidance, Control, and Dynamics (top aerospace journal, JCR Q1), IEEE Transactions on Industrial Electronics (top mechatronics and automation journal, CAS Zone 1), and IEEE/ASME Transactions on Mechatronics (top mechatronics and automation journal, CAS Zone 1). The related work has received more than 300 citations and wide recognition in the academic community (Google Scholar).

- On the engineering side, independently implemented the nonlinear control methods for multi-drone cooperative transportation from scratch. Wrote the flight control programs in C++ and ROS, and implemented the real-time flight control algorithms, as well as command control of the Pixhawk flight control computer, on the resource-constrained NVIDIA Jetson Nano onboard computer, providing a practical software solution for engineering deployment; validated the correctness and fault-tolerant control capability of the proposed methods on quadrotor drones.
- Project video and GitHub repository:
    - YouTube: https://www.youtube.com/watch?v=ejTnwAZaz20
    - GitHub: https://github.com/LonghaoQian/px4_command

Software Algorithm R&D Engineer (remote) — CNTech, Zhongfang Intelligent Technology (Shanghai) Co., Ltd.

2016/02 – 2020/09 · www.cntech.com · Zhongfang Building, Lingang Songjiang Science and Technology City, 1005 Jiuxin Road, Songjiang District, Shanghai, China (near Shunqing Road)

Work achievements:

- Worked on flight dynamics simulation algorithms and software system R&D, participating in the overall design, testing, and qualification of flight simulation software systems. Built flight simulation software systems covering two mainstream aircraft types, the A320 and the C172, and participated in their debugging and result qualification, laying the foundation for the company's A320 and C172 flight simulation products.
- Wrote, in C++, a simulation tool library that can replace Simulink's modular simulation functionality, making the flight simulation software fully domestically developed. The library not only meets all the requirements of flight simulation but can also simulate general dynamic systems such as spacecraft, power systems, and robotic systems; it also serves as an important functional module for building integrated aircraft design and simulation software, laying the foundation for the company's subsequent independently developed simulation software products.
- Built a range of simulation modules with Simulink, including a six-degree-of-freedom flight simulation model, an aircraft stall simulation model, a landing-gear impact model, a hydraulic power model, and an electrical power system control model, providing very important prototypes and theoretical foundations for the company's promotion, project applications, and engineering projects, and earning high recognition from company management.
- As second inventor, proposed a method for determining the forces exerted by the landing gear on an aircraft during takeoff and landing on a ski-jump deck: by computing the aircraft's position and velocity relative to the deck, the rotation matrices between the aircraft, deck, and ground inertial frames, the landing-gear compression and compression rate, and the tire normal force and friction coefficients, the method determines the landing-gear forces acting on carrier-based aircraft during ski-jump takeoff and landing. Granted as a Chinese invention patent (Patent No. ZL201610788314.1, Publication No. CN107798153B).
- As a senior software algorithm R&D engineer, assisted the company in conducting five rounds of technical interviews, contributing to the selection of new talent.
- Responsible for theory lectures and training for new employees, covering advanced Simulink usage and the implementation of state machines in Simulink.

Education

- 2016/09 – 2021/03 · Ph.D., Aerospace Science and Engineering
  University of Toronto, Institute for Aerospace Studies
  Supervisor: Dr. Hugh H.T. Liu — Fellow of the Canadian Academy of Engineering; Professor and Ph.D. supervisor at the University of Toronto Institute for Aerospace Studies; Director of the University of Toronto Centre for Aerial Robotics Research and Education.
- 2013/09 – 2016/03 · Master's degree, Aeronautical and Astronautical Science and Technology
  Shanghai Jiao Tong University, School of Aeronautics and Astronautics
  Supervisor: Prof. Shiqiang Hu — Vice Dean and Party Secretary of the School of Aeronautics and Astronautics, Shanghai Jiao Tong University; Professor and Ph.D. supervisor.

- 2014/01 – 2014/12 · Master's degree, Aerospace Engineering
  University of Toronto, Institute for Aerospace Studies
  Supervisor: Dr. Hugh H.T. Liu — Fellow of the Canadian Academy of Engineering; Professor and Ph.D. supervisor at the University of Toronto Institute for Aerospace Studies; Director of the University of Toronto Centre for Aerial Robotics Research and Education.
- 2009/09 – 2013/06 · Bachelor's degree, Aeronautical Engineering
  Shanghai Jiao Tong University, School of Aeronautics and Astronautics
- 2011/09 – 2013/06 · Second bachelor's degree, Applied Electronic Technology
  Shanghai Jiao Tong University, School of Aeronautics and Astronautics

Publications

Published / accepted

SciTech

Selective CBF/HOCBF Tube Constraints for NMPC of a Sloshing-Affected Tilt-Rotor VTOL Aircraft
Keilan Pieper, Longhao Qian, and Hugh H.-T. Liu
In AIAA 2027 SciTech Forum, 2027
Corresponding author, project lead · Accepted at the AIAA 2027 SciTech Forum, a top aerospace conference

CDC

Neural Robust Control on Lie Groups Using Contraction Methods (Extended Version)
Yi Lok Lo, Longhao Qian, and Hugh H.-T. Liu
arXiv preprint arXiv:2604.01448, 2026
Corresponding author, project lead · Accepted at the IEEE Conference on Decision and Control (CDC 2026), a top conference in control science

SciTech

Contraction-based Neural Control for Cooperative Aerial Payload Transportation with Variable-length Cables
Yi Lok Lo, Longhao Qian, and Hugh H.-T. Liu
arXiv preprint arXiv:2606.20127, 2026
Corresponding author, project lead · Accepted at the AIAA 2027 SciTech Forum, a top aerospace conference

JGCD

Observability-aware control for quadrotor formation flight with range-only measurement
Hei Shing Helson Go, Ching Lok Chong, Longhao Qian, and Hugh H.-T. Liu
Journal of Guidance, Control, and Dynamics, 2026
Top aerospace journal (JCR Q1) · Corresponding author, project lead

SCTS

Hybrid reinforcement learning control for UAV territory guarding with cooperative angle-of-arrival localization
Wenjie Zhuang, Longhao Qian, and Hugh H.-T. Liu
Science China Technological Sciences, 2026
CAS Zone 1 top journal · Corresponding author, project lead

SciTech

Investigating Multi-UAV Territory Guarding Using Cooperative-Competitive Reinforcement Learning
Jitendra Yuvaraja Singam, Longhao Qian, Wenjie Zhuang, and Hugh H.-T. Liu
In AIAA SciTech 2026 Forum, 2026
Corresponding author, project lead · Top aerospace conference

SWC

Autonomous Drone Operator Localization Using UAVs With Reinforcement Learning
Longhao Qian, Jitendra Yuvaraja Singam, and Hugh H.-T. Liu
In IEEE Smart World Congress 2025, Calgary, Alberta, Canada, 2025

SCIS

A path planning algorithm for a crop monitoring fixed-wing unmanned aerial system
Longhao Qian, Yi Lok Lo, and Hugh H.-T. Liu
Science China Information Sciences, 2024
Top journal in information engineering (CAS Zone 1)

WF-IoT

Energy Aware Planning of A Quadrotor With 5G Access Point in Disaster Response
Longhao Qian, Yi Lok Lo, and Hugh H.-T. Liu
In 2024 IEEE 10th World Forum on Internet of Things (WF-IoT), 2024

WF-IoT

Robust Stabilization of a Quadrotor as a 5G Access Point Using Acceleration Feedback
Longhao Qian and Hugh H.-T. Liu
In 2023 IEEE 9th World Forum on Internet of Things (WF-IoT), Aveiro, Portugal, 2023

SciTech

Data-Driven and Robust Path-following Control of a Quadrotor Slung Load Transport System
Hei Shing Helson Go, Longhao Qian, and Hugh H.-T. Liu
In AIAA SciTech 2023 Forum, 2023

JGCD

Robust Control Study for Tethered Payload Transportation Using Multiple Quadrotors
Longhao Qian and Hugh H.-T. Liu
Journal of Guidance, Control, and Dynamics, 2022
Top aerospace journal (JCR Q1)

TMECH

Guidance and Control Law Design for a Slung Payload in Autonomous Landing: A Drone Delivery Case Study
Longhao Qian, S. Graham, and Hugh H.-T. Liu
IEEE/ASME Transactions on Mechatronics, 2020
Top journal in mechatronics and automation (CAS Zone 1)

TIE

Path-Following Control of A Quadrotor UAV With A Cable-Suspended Payload Under Wind Disturbances
Longhao Qian and Hugh H.-T. Liu
IEEE Transactions on Industrial Electronics, 2019
Top journal in mechatronics and automation (CAS Zone 1)

SciTech

Path Following Control of Multiple Quadrotors Carrying A Rigid-body Slung Payload
Longhao Qian and Hugh H.-T. Liu
In AIAA SciTech 2019 Forum, 2019

CSME

A payload-quadrotor system modelling analysis
Hugh H.-T. Liu and Longhao Qian
In Canadian Society for Mechanical Engineering (CSME) Congress, London, Ontario, 2019

CCECE

Dynamics and control of a quadrotor with a cable suspended payload
Longhao Qian and Hugh H.-T. Liu
In 2017 IEEE 30th Canadian Conference on Electrical and Computer Engineering (CCECE), 2017

JZU

Analytical inverse kinematics algorithm for double-octahedral variable geometry truss manipulators
Longhao Qian, Shiqiang Hu, and Yongsheng Yang
Journal of Zhejiang University (Engineering Science), 2017

Under review

arXiv

A Robust Neural Control Design for Multi-drone Slung Payload Manipulation with Control Contraction Metrics
Xinyuan Liang, Longhao Qian, Yi Lok Lo, and Hugh H.-T. Liu
arXiv preprint arXiv:2510.01489, 2025
Under review

Automatica

Robust Anti-windup Tracking Control For A Pair of Quadrotors Carrying A Rigid-body Payload With Variable-Length Cable
Longhao Qian, Yi Lok Lo, and Hugh H.-T. Liu
Automatica
Under review

JGCD

Robust Neural Contraction Slung Load Manipulation With Active Cable Length Control
Longhao Qian, Yi Lok Lo, and Hugh H.-T. Liu
Journal of Guidance, Control, and Dynamics
Under review

Granted patents

- Ye L, Qian L, Liang L. Method for determining the forces exerted by the landing gear on an aircraft during takeoff and landing on a ski-jump deck. Chinese invention patent ZL201610788314.1, Publication No. CN107798153B, granted 2021-03-23 (filed 2016-08-31). Second inventor; assignee: CNTech, Zhongfang Intelligent Technology (Shanghai) Co., Ltd.

Teaching

AER1202 Advanced Flight Mechanics

University of Toronto

- **Terms:** 2025/09 – 2025/12; 2026/09 – 2026/12 (as UTIAS staff)
- **Language of instruction:** English
- **Course content:** A graduate course at the University of Toronto Institute for Aerospace Studies. The course covers the principles of advanced flight mechanics, flight dynamics modeling and analysis, modern flight control system design, and flight simulation methods.
- **Role:** In 2026, I teach this course as the lead instructor, as a UTIAS staff member.
- Course website (with YouTube lecture videos)

AER1216 Fundamentals of Unmanned Aerial Vehicles

University of Toronto

- **Terms:** 2023/09 – 2023/12; 2024/09 – 2024/12
- **Language of instruction:** English
- **Course content:** A graduate course at the University of Toronto Institute for Aerospace Studies. The course covers UAV dynamics, flight mechanics, automatic control, and hardware and software design.
- Lecture videos (YouTube)

AER1217 Autonomy of UAS

University of Toronto

- **Terms:** 2024/01 – 2024/04; 2025/01 – 2025/04
- **Language of instruction:** English

- **Course content:** A graduate course at the University of Toronto Institute for Aerospace Studies. The course covers the design of autonomous UAV systems, path planning and decision-making algorithms, state estimation and sensor fusion, and autonomous flight software architecture.
- Lecture videos (YouTube)

Conference presentations

Conference	Date	Role
IEEE 10th World Forum on Internet of Things	2024/11/11	Presentation
Canadian Aeronautics and Space Institute (CASI) AERO 2023	2023/11/15	Presentation
IEEE 9th World Forum on Internet of Things	2023/10/12	Presentation
2023 AIAA Science and Technology Forum and Exposition (AIAA SciTech Forum)	2023/01/23	Presentation
IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM) 2020	2020/07/06	Presentation
2019 AIAA Science and Technology Forum and Exposition (AIAA SciTech Forum)	2019/01/06	Presentation
8th Conference on Systems and Control Theory	2018/05/07	Presentation
Canadian Conference on Electrical and Computer Engineering (CCECE) 2017	2017/04/30	Presentation

Professional service

Memberships of international societies

Society	Membership	Validity
Institute of Electrical and Electronics Engineers (IEEE)	Member	Ongoing
American Institute of Aeronautics and Astronautics (AIAA)	Member	Ongoing

Reviewer for international journals and conferences (110 reviews in total)

Journals: AIAA Journal of Guidance, Control, and Dynamics · IEEE Transactions on Industrial Electronics · IEEE Transactions on Systems, Man, and Cybernetics: Systems · IEEE Transactions on Control Systems Technology · IEEE Transactions on Automatic Control · IEEE/ASME Transactions on Mechatronics · IEEE Transactions on Aerospace and Electronic Systems · IEEE Transactions on Intelligent Vehicles · IEEE Robotics and Automation Letters · IEEE Transactions on Robotics · Unmanned Systems · Journal of Aerospace Engineering · International Journal of Aerospace Engineering · Aerospace Science and Technology · Journal of Systems and Control Engineering · Drones

Conferences: IEEE International Conference on Robotics and Automation (ICRA) · IEEE Conference on Decision and Control (CDC) · IEEE Canadian Conference on Electrical and Computer Engineering (CCECE) · American Control Conference (ACC)

Conference program committees

- The 23rd IEEE International Conference on Industrial Informatics (INDIN 2025) — Track Program Committee (TPC) reviewer (Factory Communications, Control and Automation Systems)
- 2025 IEEE 11th World Forum on Internet of Things (WF-IoT 2025) — Track Program Committee (TPC) reviewer

Awards

Industry awards

Date	Award
2023/04	Huawei annual performance evaluation: A rating
2023/01	HiSilicon Quality Star Award (Huawei)
2021/08	HiSilicon New Star Award (Huawei)

Scholarships

Date	Institution	Scholarship
2017/02	University of Toronto	Ontario Trillium Scholarship (only 75 recipients across Ontario; C$160,000 in total, approx. RMB 820,000)
2011/09	Shanghai Jiao Tong University	Shanghai Jiao Tong University Third-Class Scholarship
2010/09	Shanghai Jiao Tong University	Shanghai Jiao Tong University Third-Class Scholarship
2010/03	Shanghai Jiao Tong University	Shanghai Jiao Tong University Third-Class Scholarship

Academic contribution awards

Year	Award
2024	Excellent Reviewer for the Journal of Guidance, Control, and Dynamics (JGCD)
2022	Excellent Reviewer for the Journal of Guidance, Control, and Dynamics (JGCD)