Qiayuan Liao

✉ qiayuanl@berkeley.edu
🌐 qiayuanl.netlify.app
🐙 qiayuanliao

Design it, build it, break it, fix it, and optimize it.

Education

2023–Present	**Ph.D. Student Mechanical Engineering**, *University of California, Berkeley*, Berkeley. Advisor: Koushil Sreenath Major: Controls
2019–2023	**B.E Mechatronics Engineering**, *Guangdong University of Technology*, China.

Professional Experience

Academic

2022–2023 Undergraduate Researcher, *Hybrid Robotics (Prof. Koushil Sreenath)*, University of California, Berkeley.
- Developed **legged_control** [S1], a Nonlinear MPC and WBC framework for legged robot based on OCS2 and ros-controls.
- Worked on adding the exponential DCBF duality constraints to an NMPC controller for obstacle avoidance in quadruped robot locomotion [S2].
- Implemented all code and conducted all experiments independently.
- Results [C1] accapted by **IROS2023**.

2021–2023 Undergraduate Researcher, *CLEAR Lab (Prof. Wei Zhang)*, Southern University of Science and Technology.
- Developed **cheetah_ros** [S3], a hardware and simulation interface of quadruped robot (Unitree's Aliengo) based on ros-control, and Cheetah-Software.
- Worked on controlling a quadruped robot to bump the ball in the air to the desired position using trajectory optimization and convex-MPC.
- Implemented all code and conducted all experiments independently.

2019–2021 Captain & Founder, *DynamicX Robot Team*, Guangdong University of Technology
- Found and led a team of up to 45 people building and controlling seven different robots and participating in the RoboMaster University Championship. (More than 400 universities worldwide and 35000 students participated in this competition).
- Designed and manufactured the mechanical structure.
- Developed **rm-controls** [S4], control and simulation framework for RoboMaster competition robot based on ROS. Implemented the PID, LQR, and some kinematics algorithms and programs of the robots mentioned above.
- Developed a ROS driver and firmware for synchronizing the high-speed camera with IMU [S5] and a target detecting and tracking program using OpenCV and Kalman Filter.

Skills

Control	Experience using TO [C2], NMPC [C1, S1], MPC [C2], TVLQR, LQR [S4], Kalman Filter [C1, C2, S1, S3, S4], and PID [S4] on real robots.
Fabricate	Design: Onshape Fusion 360, KiCAD, Solidworks; Fabrication: CNC mill and 3D print.
Program	C++ [S1, S2, S3, S4, S5], C [S5, S6], Python with strict format and clear code.
Tools	Expert on ROS1 with ros-control and Gazebo [S1, S2, S3, S4]; Frequent use of LaTeX, Linux, Git, OpenCV.

Publications

Publications Statistics:

Conference Proceedings:	2
Selected Open Source Software:	6

Open Source Softwares Statistics:

Total Stars Earned:	**800+**
Total Commits:	3.4k

Conference Proceedings

[C1] **Qiayuan Liao**, Zhongyu Li, Akshay Thirugnanam, Jun Zeng, and Koushil Sreenath. Walking in narrow spaces: Safety-critical locomotion control for quadrupedal robots with duality-based optimization. In *2023 IEEE International Conference on Intelligent Robots and Systems (IROS)*, 2023. [pdf], [arxiv] [video].

[C2] Qiayuan Liao, Zhefeng Cao, Hua Chen, and Wei Zhang. Real-time trajectory optimization and control for ball bumping with quadruped robots. *arXiv preprint arXiv:2210.05195*, 2022.

Selected Open Source Softwares

[S1] legged_control: a Nonlinear MPC, WBC framework for legged robot based on OCS2, and ros controls. **499 Stars**. [code], [video].

[S2] Implementation of paper [C1] based on [S1]. [code].

[S3] cheetah_ros: a hardware and simulation interface of quadruped robots based on ros-control, and Cheetah-Software. [code].

[S4] rm-controls: a software stack based on ros-controls for controlling RoboMaster robots. **130 Stars**. [code], [docs], [videos].

[S5] Camera and IMU synchronization. [camera code], [IMU code].

[S6] A Real time patched kernel (4.4.86) and testing tools for UP board Ubuntu. [code].

Additional Info

Jounal Reviewer
○ IEEE Robotics and Automation Letters, 2023.

Conference Reviewer
○ IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2022

Academic Collaborators
○ Prof. Koushil Sreenath, UC Berkeley
○ Prof. Wei Zhang, SUSTech

Industry Collaborators
○ Xingxing Wang, Unitree Robotics
○ Xingye (Dennis) Da, XPeng Robotics

Leadership
○ Once led a team whose number exceeds 80 for two years, about half of which are active duty and the other part are preparatory intern members;
○ Handled dozens of projects with a year-long development cycle at the same time;
○ Interactived with dozens of people and assigned tasks daily.

Awards and Honors

2021	RoboMaster University Championship (more than 200 Chinese teams at the time)	*Top 32*
2020	Guangdong University of Technology student scholarship	*1st Class*
2019	RoboMater Winter Camp for High School Students	*Champion*
2018	Denmark Young Scientists Fair and Contest	*1st Place*