

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

Education

2019–2023 **B.S. in Electromechanical Engineering**, *Guangdong University of Technology*, Guangzhou, China.
(Expected)

Professional Experience

Academic

2022– **Undergraduate Researcher**, *Hybrid Robotics (Prof. Koushil Sreenath)*, Univ. of California, Berkeley.

- Development of **legged_control** [S1], a Nonlinear MPC and WBC framework for legged robot based on OCS2 and ros-controls.
- Working on adding the exponential DCBF duality constraints to an NMPC controller for obstacle avoidance in quadruped robot locomotion [S2].
- Research results [C1] submitted to **ICRA2023** (under review)

2021– **Undergraduate Researcher**, *CLEAR Lab (Prof. Wei Zhang)*, Southern University of Science and Technology.

- Development of **cheetah_ros** [S3], a hardware and simulation interface of quadruped robot (Unitree's Aliengo) based on ros-control, and Cheetah-Software.
- Working on controlling a quadruped robot bumps the ball in the air to the desired position using trajectory optimization and convex-MPC.
- Research results [C2] submitted to **ICRA2023** (under review).

2019–2021 **Captain & Founder**, *DynamicX Robot Team*, Guangdong University of Technology Full-Stack Developing and Management.

- Found and led a team of up to 45 people building and controlling seven different robots in participating in the RoboMaster University Championship. (More than 400 universities around the world participated, and 8000 young engineers competed in the RoboMaster competition).
- Designed and manufactured the mechanical structure of
 - Mecanum, Swerve Drive, and Omini Wheel chassis;
 - Two-axis gimbal and ball shooter system;
 - Five-axis robot arm;Supervised all the designs and drawing before manufacturing.
- Developed **rm-controls** [S4], an 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 of the high-speed camera and IMU timestamp synchronization[S5] and a target detecting and tracking program using OpenCV.

Industry

2018–2019 **Emebbed Engineer Intern**, *DJI Technology Co., Ltd*, RoboMaster High-School Students vacation Vacation Camp.

- PID-based control with BLDC motor by CAN interface on STM32 and Jetson TX2.
- Mecanum wheel chassis's velocity and position and three-axis robot arm's kinematics control.
- Localization accounting AprilTag and IMU, navigate using navigation ROS package.

2015–2018 **Individual Developer**, *High and Middle School*.

- Reproduced several open-source FDM 3D printers (kossel) in middle school.
- Developed a novel desktop **Selective-Laser-Sintering 3D printer** in high school.

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.

Mechanics	Design robot prototypes rapidly using Fusion 360, Solidworks; Manufacture by CNC 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 L ^A T _E X, Linux, OpenCV.

Publications

Publications Statistics:

Conference Proceedings:	2
Selected Open Source Software:	6

Open Source Softwares Statistics:

Total Stars Earned:	390
Total Commits:	3.1k

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 Robotics and Automation (ICRA)*, Under Review.
- [C2] **Qiayuan Liao**, Zhefeng Cao, Hua Chen, and Wei Zhang. Real-time trajectory optimization and control for ball bumping with quadruped robots. In *2023 IEEE International Conference on Robotics and Automation (ICRA)*, Under Review. [[pdf](#)], [[video](#)].

Selected Open Source Softwares

- [S1] legged_control: a Nonlinear MPC, WBC framework for legged robot based on OCS2, and ros controls. **160 Stars**. [[code](#)], [[video](#)].
- [S2] Implementation of paper [C1] based on [S1]. [[code](#)].
- [S3] cheetah_ros: a hardware, simulation interface of quadruped robot (Unitree's Aliengo) based on ros control, and Cheetah-Software. [[code](#)].
- [S4] rm-controls: a software stack based on ros-controls for controlling RoboMaster robots. **110 Stars**. [[code](#)], [[docs](#)].
- [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

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

Team Management

- 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 more than ten projects at the same time. The development duration is about one year.
- Interactive with dozens of people daily; Assign tasks to solve the problems of seven robots.

Awards and Honors

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