FU ZHENGYU

zhenfu@student.ethz.ch| http://fu-zhengyu.xyz | https://github.com/Huoleit

EDUCATION

ETH Zurich **Zurich, Switzerland**

MSc in Robotics, Systems and Control Sep 2023 – Present

The Hong Kong University of Science and Technology **Hong Kong**

BSc in Computer Engineering (CPEG) & Integrative Systems and Design (ISD) Sep 2018 – May 2023

- First-class honours
- Awards & Scholarships: Dean's List, University's Scholarship of Continuing Undergraduate Students, HKSAR Government Scholarship Fund - Talent Development Scholarship, HKSAR Government Scholarship Fund - Reaching Out Award

Carnegie Mellon University **Pittsburgh, United States**

Robotics Institute Summer Scholars (RISS) Jun 2022 – Aug 2022

- Supervisor: Prof. Dr. Zachary Manchester

ETH Zurich **Zurich, Switzerland**

Invited visiting student at Robotic Systems Lab (RSL) Sep 2021 – May 2022

- Grade: 6/6
- Supervisor: Prof. Dr. Marco Hutter, Dr. Farbod Farshidian

PUBLICATIONS

- Yang, S., Zhang, Z., **Fu, Z.**, and Manchester, Z., *Cerberus: Low-Drift Visual-Inertial-Leg Odometry For Agile Locomotion*, 2023 IEEE International Conference on Robotics and Automation (ICRA) **Accepted**
  A preprint is available at https://arxiv.org/abs/2209.07654

RESEARCH EXPERIENCES

Primal-Dual Augmented Lagrangian Solver for Model Predictive Control **REx Lab, CMU**

Robotics Institute Summer Scholar (RISS) Jun 2022 – Aug 2022

- Proposed a numerical implementation of a primal-dual formulation of the augmented Lagrangian in C++, which was two times faster than OSQP in solving dynamically constrained control problems of planar drones.
- Implemented a block-wise LDL routine in C with BLAS, which exploited the sparsity of the optimal control problems. The block-wise LDL was superior to QDLDL when the linearised dynamics matrices with moderate size were densely populated, even though state and input cost matrices were diagonal.
- The RISS presentation is available at https://www.youtube.com/watch?v=9xK1cLN08k8
- The RISS paper is available at https://bit.ly/risspaper

Optimal Control Solvers for Legged Robots **RSL, ETH Zurich**

Bachelor Thesis Student Sep 2021 – May 2022

- Implemented a parallelizable QP solver named Proportional-Integral Projected Gradient (PIPG) under the nonlinear MPC (NMPC) framework of OCS2, which verified the feasibility of boosting control frequency by parallel computing. For more information, please see my Bachelor thesis at https://bit.ly/rslthesis (Note: OCS2 is a C++ toolbox tailored for Optimal Control for Switched Systems)
- Revised the parallelization scheme of the backward pass of differential dynamic programming (DDP) in OCS2, which improved the performance by 18%. The pull requests (PRs) are merged into the main branch, and the toolbox is available at https://github.com/leggedrobotics/ocs2

PROJECT EXPERIENCES

Joint Spatial-Temporal Motion Planning for Manipulators — **RoboticsX, Tencent**

Software Engineer (Internship) — Jun 2023 – Aug 2023

- Implemented Safe Interval Path Planning (SIPP) with Trajectory Optimization (TO) to improve the motion planning of manipulators in dynamic environments. The method explores planning possibilities in both spatial and time domains, enabling planning of the "wait" action between "move" active to avoid getting stuck into certain local minima.
- A demonstration can be viewed on https://youtu.be/5JieOrueuSY

State Estimation, Planning and Control for Quadrotors — **Department of ECE, HKUST**

Software Engineer (Coursework) — Mar 2021 – Jun 2021

- Implemented a feature-based Visual Odometry (VO) with ROS integration.
- By using the Extended Kalman Filter (EKF), the estimated states from the VO were fused with the data from the on-board IMU to obtain better performance.
- A minimum snap trajectory was generated offline and tracked online by a quadrotor in a moderately convoluted indoor environment.
- A real-world experiment can be viewed on http://fu-zhengyu.xyz/quadrotor/

Control of Industrial Manipulators — **Hong Kong Centre For Logistics Robotics**

Software Engineer (Internship) — Jan 2021 – Feb 2021

- Implemented a ros2_control-compatible hardware interface for NACHI MZ25 manipulator in ROS2 Foxy
- A demonstration can be viewed on https://youtu.be/Z5zkLPai2QI

Multi-agent System Control — **Department of ECE, HKUST**

Undergraduate Research Assistant — Jun 2020 – Aug 2021

- Implemented an iterative linear quadratic regulator (iLQR) with MPC to control differential wheeled robots. A demonstration can be viewed on https://youtu.be/XL8FVjdYE0M
- Implemented graph-based formation controllers in ROS Melodic and verified the controllers in a simulated environment in Gazebo. A demonstration can be viewed on http://fu-zhengyu.xyz/relative_formation/

RoboMaster Competition — **Robotics team, HKUST**

Software Engineer — Oct 2018 – Sep 2019

- In charge of designing and implementing a quaternion-based attitude controller for a 2-axis stabilizer.
- Implemented a forward kinematics solver and motor controllers for a Mecanum mobile platform.
- Designed and implemented the major codebase for the infantry robots.
- Team Website - https://www.robomasterhkust.com/

TEACHING EXPERIENCES

Mechatronic Systems Design with Embedded Computing — **Department of ECE, HKUST**

Teaching Assistant — Feb 2021 – May 2021

- Designed lab manuals and programming exercise to familiarise students with Arm®-based microcontrollers.
- In charge of leading laboratory sessions

AWARDS & CERTIFICATIONS

- 2019 RoboMaster International qualification tournament, RoboMaster — 1st Prize
- Cyber Defenders Challenge – Team Up for the Good Fight, China Everbright Bank & HKUST — 1st Prize
- 2016 RoboCup Junior Rescue Line International Competition in Leipzig, Germany — 1st Prize

SKILLS

Programming	**(Well-experienced in)**C++, C, Python, MATLAB, ROS**;(Capable of)**Julia, JavaScript, ROS2
Mechanical	CAD software(Rhino, Solidworks, Fusion 360), Physical prototyping(CNC, Laser cutter, water jet)