### **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
<ul> <li>BSc in Computer Engineering (CPEG) &amp; Integrative Systems and Design (ISD)</li> <li>First-class honours</li> <li>Awards &amp; Scholarships: Dean's List, University's Scholarship of Continuing Undergraduat HKSAR Government Scholarship Fund - Talent Development Scholarship, HKSAR Government Reaching Out Award</li> </ul>	Sep 2018 – May 2023 e Students, ment Scholarship Fund -
Carnegie Mellon University	Pittsburgh, United States
<ul> <li>Robotics Institute Summer Scholars (RISS)</li> <li>Supervisor: Prof. Dr. Zachary Manchester</li> </ul>	Jun 2022 – Aug 2022
ETH Zurich	Zurich, Switzerland
<ul> <li>Invited visiting student at Robotic Systems Lab (RSL)</li> <li>Grade: 6/6</li> <li>Supervisor: Prof. Dr. Marco Hutter, Dr. Farbod Farshidian</li> </ul>	Sep 2021 – May 2022
PUBLICATIONS	
• Yang, S., Zhang, Z., Fu, Z., and Manchester, Z., Cerberus: Low-Drift Visual-Inertial-Leg Odor	metry For Agile Locomotion,
2023 IEEE International Conference on Robotics and Automation (ICRA) A preprint is available at <u>https://arxiv.org/abs/2209.07654</u>	Accepted

#### RESEARCH EXPERIENCES

#### Primal-Dual Augmented Lagrangian Solver for Model Predictive Control Robotics Institute Summer Scholar (RISS)

- 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 <a href="https://www.youtube.com/watch?v=9xK1cLN08k8">https://www.youtube.com/watch?v=9xK1cLN08k8</a>
- The RISS paper is available at <a href="https://bit.ly/risspaper">https://bit.ly/risspaper</a>

## **Optimal Control Solvers for Legged Robots**

Bachelor Thesis Student

- 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 <a href="https://github.com/leggedrobotics/ocs2">https://github.com/leggedrobotics/ocs2</a>

RSL, ETH Zurich

Sep 2021 – May 2022

# REx Lab, CMU

Jun 2022 – Aug 2022

#### PROJECT EXPERIENCES

#### Joint Spatial-Temporal Motion Planning for Manipulators

Software Engineer (Internship)

- 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 at https://youtu.be/5JieOrueuSY

#### State Estimation, Planning and Control for Quadrotors Software Engineer (Coursework)

- 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 at <a href="http://fu-zhengyu.xyz/quadrotor/">http://fu-zhengyu.xyz/quadrotor/</a>

#### Control of Industrial Manipulators

Software Engineer (Internship)

- Implemented a ros2\_control-compatible hardware interface for NACHI MZ25 manipulator in ROS2 Foxy
- A demonstration can be viewed at https://youtu.be/Z5zkLPai2QI

#### Multi-agent System Control

Undergraduate Research Assistant

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

#### **RoboMaster Competition**

Software Engineer

- 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.

#### TEACHING EXPERIENCES

#### Mechatronic Systems Design with Embedded Computing

Teaching Assistant

- 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	1 <sup>st</sup> Prize
•	Cyber Defenders Challenge – Team Up for the Good Fight, China Everbright Bank & HKUST	1 <sup>st</sup> Prize
•	2016 RoboCup Junior Rescue Line International Competition in Leipzig, Germany	1 <sup>st</sup> 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)	

#### Hong Kong Centre For Logistics Robotics

Jan 2021 – Feb 2021

**RoboticsX**, Tencent Jun 2023 – Aug 2023

#### **Department of ECE, HKUST**

Jun 2020 – Aug 2021

**Robotics team, HKUST** Oct 2018 – Sep 2019

Department of ECE, HKUST

Feb 2021 – May 2021

**Department of ECE, HKUST** 

Mar 2021 – Jun 2021