Jianzhuang Zhao

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Research Interests

My research interests are in the intersection of machine learning and control theory, specifically focusing on contact-rich manipulation tasks for mobile manipulators in human co-existence environments. To that end, my research includes three parts:

○ **High-level manipulation skills learning:** the skills can be acquired from human demonstrations or trained from simulators by machine learning approaches

○ **Whole-body motion planning and control:** distribute the learned high-level skills to low-level joint velocity/torque for mobile manipulators

○ **Interaction detection and adaptation:** detect the real-time contact information, adapt to unforeseen disturbances, and ensure the safety of human and robot

Areas: Robot Learning, Mobile Manipulation, Human-robot Interaction and Collaboration, (Variable) Impedance Control

Education

Istituto Italiano di Tecnologia (IIT) & Politecnico di Milano **Genova, Italy**
Ph.D in Bioengineering (Robotics Direction) *Nov 2021 – Dec 2024(Anticipated)*
Advisors: Dr. Arash Ajoudani & Prof. Elena De Momi

Xi'an Jiaotong University, School of Mechanical Engineering **Xi'an, China**
Master in Mechanical Engineering *Sep 2018 – Jun 2021*
Advisors: Prof. Kedian Wang & Prof. Fei Zhao

Zhengzhou University, School of Mechanical Engineering **Zhengzhou, China**
Bachelor in Mechanical Engineering *Sep 2014 – Jul 2018*
Advisor: Prof. Jianshe Gao

HONORS AND AWARDS

○ Finalist of IROS 2022 Best Paper Award on Mobile Manipulation, Oct 2022

○ Outstanding Graduate of Shaanxi Province (Only one for master students in ME school), Jun 2021

○ Outstanding Student Award (Highest Student Honor in XJTU), Oct 2020

○ National Scholarship (top 1%), China Ministry of Education, Oct 2019, 2020 (twice)

○ Outstanding Graduate of Henan Province, Jun 2018

○ National Encouragement Scholarship, Education Department of Henan, Dec 2017

○ Special Baosteel Scholarship, BAOSTEEL GROUP, Nov 2017 (Only 25 persons per year in China from undergraduate to Ph.D candidate)

○ First Prize of IEEE ICRA 2019 RoboMaster AI Challenge, IEEE RAS, May 2019

○ First Prize of China Robot Competition & RobCup open Competition, Oct 2015

○ Second Prize of China Robot Innovation Competition for Graduate Students, Oct 2020

PUBLICATIONS

○ **J. Zhao**, A. Giammarino, E. Lamon, J. M. Gandarias, E. D. Momi and A. Ajoudani, "A Hybrid Learning and Optimization Framework to Achieve Physically Interactive Tasks With Mobile Manipulators," IEEE Robotics and Automation Letters (RA-L & IROS, Finalist of IROS Best Paper Award on Mobile Manipulation), 2022. [link]

- **J. Zhao**, G. J. G. Lahr, F. Tassi, A. Santopaolo, E. D. Momi and A. Ajoudani, "Impact-Friendly Object Catching at Non-Zero Velocity Based on Combined Optimization and Learning," IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2023. [link]
- L. Zhang*, **J. Zhao***, E. Lamon, Y. Wang, X. Hong, "Energy Efficient Multi-Robot Task Allocation Constrained by Time Window and Precedence," IEEE Transactions on Automation Science and Engineering (T-ASE), 2023. [link]
- **J. Zhao**, K. Liu, F. Zhao, Z. Sun. "Design and Kinematic Analysis on a Novel Serial-Parallel Hybrid Leg for Quadruped Robot," International Conference on Intelligent Robotics and Applications (ICIRA), 2019. [link]

ACADEMIC SERVICES

Journal reviewer
- IEEE Robotics and Automation Letters (RA-L), IEEE Transactions on Haptics (ToH), IEEE Transactions on Industrial Electronics (TIE), Robotica, Control Engineering Practice

Conference reviewer
- ICRA (2020, 2021, 2024)
- IROS (2022, 2023)
- ROBIO (2023)

ADVANCED TECHNICAL SKILLS & KNOWLEDGE AREAS

Theoretical
- Robot Design & Modeling, Imitation/Reinforcement Learning
- (Variable) Impedance Control, Model Predictive Control (MPC)

Practical
- Linux, Robotic Operating System (ROS), C/C++, Python
- Git, Matlab, Solidworks, Latex

LANGUAGE

- **Chinese** [mother tongue]
- **English** [fluent]
- **Italian** [basic]

THESIS PROJECTS

Research on Vehicle-arm Integrated Modeling and Whole-body Impedance Control of Mobile Manipulator
Master Thesis *Sep 2019 – May 2021*
- Hardware: Franka Emika Panda Robotic Arm & Omni-directional Mobile Platform(vehicle)
- Software: Robotic Operating System (ROS)
- Achieved Goals: Designed a novel coordinated Whole-body impedance control approach for mobile manipulator; Learned from human demonstration by combining DMPs frameworks and GMM/GMR approach; Opened a door without knowing the size; Designed three motion modes to achieve motion assignment of the arm and mobile platform

Kinematic Analysis and Experimental Study of A Novel Quadruped Metamorphic Robot
Bachelor Thesis(Outstanding Bachelor Thesis of Zhengzhou University) *Jan 2018 – Jun 2018*
- Introduced closed-loop six-barrel metamorphic mechanism as the body configuration of a quadruped robot; Designed a novel serial-parallel hybrid leg, built the kinematics model of the serial-parallel hybrid leg; Made a prototype with steering engine and MCU, Proved the correctness of the above analysis by experiment