# Kaiwen JIANG

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## EDUCATION

**Harbin Institute of Technology, Shenzhen**　　　　　　　　　　　　　Shenzhen, CHN
*Bachelor of Engineering in Automation*　　　　　　　　　　　　　　*Sep. 2020 – Jun. 2024*

- CGPA: 3.658/4.0; Final-year GPA: 91.34/100
- Comprehensive Ranking: 24/236
- Academic Scholarship: Second Prize (Ranking 18/236)

## PUBLICATIONS & PREPRINTS

- Kaiwen Jiang etc. "Learning Whole-Body Loco-Manipulation for Omni-Directional Task Space Pose Tracking with Wheeled-Quadrupedal-Manipulator", IEEE Robotics and Automation Letters (RAL), published in 18 December, 2024.

- Kaiwen Jiang, Zhi Li, Ying Zhang, "An Inversion-free Iterative Algorithm with a Scalar Tuning Parameter for Coupled Riccati Matrix Equation" *IEEE Transactions on Automatic Control TAC*, accepted, 2024.

- Kaiwen Jiang, Zhi Li, Ying Zhang, "The Structure-preserving Doubling Algorithm for the Discrete Coupled Riccati Matrix Equations," *Proceedings of the 2nd Conference on Fully Actuated System Theory and Applications*, July 14-16, 2023

## RESEARCH

**Research Assistant**　　　　　　　　　　　　　　　　　　　　Aug. 2024 – Present
Control & Learning for Robotics and Autonomy(CLEAR) Lab　　　　　　　SUStech University
*Supervisor: Prof. Wei Zhang*　　　　　　　　*School of System Design and Intelligent Mfg.*
*Co-Supervisor: Prof. Hua Chen*　　　　　　　*School of System Design and Intelligent Mfg.*

- **RL-based Control for Wheeled Bipedal Manipulator**. I aim to equip the Wheeled Bipedal Manipulator (WBM) with contact-awareness through deep reinforcement learning. A transformer will be used to estimate the external wrench, while an additional reactive actor-critic will be employed to reactively handle undesired contact. I am eager to venture into diverse fields, e.g. I am now interested in model-based RL, AMP & ASE, learning based perceptive loco-manipulation, Transformer's and Diffusion's application on quadrupeds/humanoids.

**Visiting Research Student**　　　　　　　　　　　　　　　　Sep. 2023 – Aug. 2024
Control & Learning for Robotics and Autonomy(CLEAR) Lab　　　　　　　SUStech University
*Supervisor: Prof. Wei Zhang*　　　　　　　　*School of System Design and Intelligent Mfg.*
*Co-Supervisor: Prof. Hua Chen*　　　　　　　*School of System Design and Intelligent Mfg.*

- **Learning-based Control:** Leveraging reinforcement learning (RL) to achieve whole-body coordination and realize loco-manipulation for omni-directional task space pose tracking with wheeled quadrupedal manipulator.
- Model-based Control: Developed a controller based on NMPC and WBC to achieve synergistic control for the quadrupedal manipulator platform. More specifically, we achieved Chicken Head Motion in reality and filmed a demo, which can demonstrate the collaboration capacity and the stability of this method.

**Undergraduate Research Assistant**　　　　　　　　　　　　　Aug. 2022 – Sep. 2023
ZHANG Ying's Lab　　　　　　　　　　　　　Harbin Institute of Technology, Shenzhen
*Supervisor: Prof. Ying Zhang*　　　　　　　*School of Mechanical Engineering and Automation*

- **Numerical Algorithm:** Proposed an inversion-free iterative algorithm with a scalar tuning parameter for coupled Riccati matrix equations(DCRMEs), the algorithm completely circumvents the need for matrix inversion during the iterative process, leading to significant improvements in convergence speed and numerical stability compared to certain benchmark algorithms.
- Optimal Control: Presented a structure-preserving doubling algorithm (SDA) tailored for the DCRMEs. Notably, SDA exhibits the advantageous properties of global convergence and quadratic convergence rate. However, a significant challenge lies in the specific form required for implementing SDA. Consequently, we solve this issue by transforming the conversion of DCRMEs into the specific form required by SDA.

## Honors & Awards

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| Finalist in the Mathematical Contest In Modeling (MCM),(Top 2%) | 2022.11–2023.3 |
| National Second Prize in the China Robot and Artificial Intelligence Competition(CRAIC) | 2023.3–7 |
| Provincial First Prize in National College Students Mathematical Contest in Modeling | 2022 |
| Academic Scholarship: Second Prize (Ranking 18/236) | 2023 |

## Selected Projects

**Legged & Manipulator Collaboration Control** — Sep. 2023 – Nov. 2023
*Advisors: Prof. Wei Zhang, Prof. Hua Chen* — *SUStech*

- **Main Tasks:** (1)We expect to develop a controller based on NMPC and WBC for synergistic control of the legged & manipulator platform. Our dog is the *Aliengo* of Unitree and the arm is the *Z*1 of Unitree. (2) It is expected to achieved a Gamepad Control Mode, via which we can manipulate the End-effector(Ee) and/or the dog. We alse anticipate to control Ee and/or dog through Rviz interaction. More specifically, for example, moving Ee to a specific position in the simulation, will also result the corresponding movement in reality.
- **Challenges:** (1) Adjust NMPC's parameters. (2) Adjust WBC's parameters. (3) The problem of sim-to-real. (4) The limitation induced by hardware and the drawback of NMPC. (5)The problem of data visualization
- **Action:(Greatly simplified version):** (1)Usage of dynamic reconfiguration (2)Avoid cheater configuration (3)Self-designed low-pass filter to optimize the reference trajectory of velocity. (4) Deploy the Hierarchical WBC
- **Result:** We achieved "Chicken Head" Motion in real world, which can demonstrate the collaboration capacity and the stability of our control.

**The Six-axis Arm Plays the Xylophone** — Mar. 2023 – May 2023
*Advisor: Prof. Yunjiang Lou, Associate Dean* — *HITSZ*

- **Main Task**: Our aim is to let the manipulator move along a particular trajectory, which is exactly the one that lead the End-effector(Ee), a plastic hammer, to hit the xylophone and play a song.
- **Action:** (1)We use MATLAB to do the arm's motion planning, using **LFPB with Via Points** trajectory planning. A user interface was developed for appointing certain melody that the arm should play. (2)Instead of utilizing some existing APIs, We programmed PoE's forward kinematic, inverse kinematic and the transformation of different expressions of orientation by ourselves.

## Skills

**Languages**: English (*IELTS* Band 7), Mandarin Chinese (native)

**Programming**: C/C++, Python, MATLAB/Simulink, Arduino, LaTeX

**Tools & Packages**: Git, PyTorch, PPO, ROS, VS Code, Ubuntu, Overleaf, PPT, MS word