JINGWEN ZHANG

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Education Background

09/2017 – 03/2023 **MAE, University of California, Los Angeles,**

Ph.D. in Mechanical Engineering, GPA: 3.98/4.0

- Research Topics: Optimization-based methods on locomotion planning, Legged robots, Intelligent design, Robot Modelling, Optimal Control

09/2015 - 12/2016 **Columbia University,**

M.Sc. in Mechanical Engineering, GPA: 4.1/4.0

09/2011 - 07/2015 **Tsinghua University,**

B.Eng. in Mechanical Engineering and Automation, GPA: 3.8/4.0

- The Excellent Graduate of Tsinghua University (2015)

Research Experience

Reinforcement Learning for Energy-Efficient Humanoid Control   06/2023 – Present

Abstract: This project aims to improve the sample efficiency, energy efficiency, and sim-to-real transferability of humanoid control policies by combining model-based methods with deep reinforcement learning. The work focuses on an energy-constrained locomotion framework (ECO) and a world-model-based pretraining and finetuning framework (LIFT), both integrated into a high-fidelity humanoid simulation and deployment stack.

➢ Designed the ECO (Energy-Constrained Optimization) framework as a constrained reinforcement learning formulation for humanoid walking, treating mechanical energy consumption as an explicit inequality constraint and training policies in large-scale parallel simulation with domain randomization, achieving ~2-6x lower energy usage than PPO-based baselines while maintaining tracking accuracy and robustness

➢ Proposed LIFT, a world-model-based training framework that combines a structured physics prior (Lagrangian whole-body dynamics) with a small neural residual model, enabling large-scale SAC pretraining in simulation followed by efficient finetuning using a learned world model and limited real-robot data

➢ Developed and calibrated high-fidelity humanoid simulation models in the isaac-based platform, performing automatic system identification of inertial and actuator parameters via CMA-ES to improve sim-to-real transfer success rates for locomotion and to provide the algorithmic foundation for downstream loco-manipulation and long-horizon tasks.

A Miniature Bipedal Robot with Proprioceptive Actuation   06/2020 – 06/2023

Abstract: BRUCE (Bipedal Robot Unit with Compliance Enhanced) is a new-generation miniature bipedal robotic platform for studies on humanoid dynamic behaviors. The development in design and control is planned to be made open-source in the future. BRUCE is in favor of highly dynamic motions thanks to the proprioceptive actuation and unique joint design on the hip and ankle.

➢ Integrated IMU and foot contact sensors into the overall system

➢ Developed the software architecture based on a custom shared memory and the multi-threading

➢ Cooperated to implement a two-level robust dynamic walking controller. The high-level planner determines both the location and duration for the next few steps based on the divergent component of motion. The low-level controller leverages the full-body dynamics to establish the foot contact as planned while regulating other task-space behaviors, e.g., center of mass height and torso orientation.

➢ Developed a jumping control framework with heuristic landing for bipedal robots. Specifically, the high-level jumping planner with centroidal momentum is solving a NLP offline to get the local-optimal jumping

trajectory. A novel heuristic landing planner updates the landing positions in a real-time manner during the flight phase based on the momentum feedback. To the best of our knowledge, this is the first approach to take advantage of the flight phase to reduce the impact of the jump landing which is implemented in the actual robot. The low-level whole-body controller is finding the required joint torques to best accomplish the operational-space tasks by solving a small-scale QP.

Motion planning for Multi-Limbed Vertical Climbing Robots   01/2019 – 12/2022

Abstract: To achieve autonomous vertical wall climbing for multi-limbed robots, motion planning requires a unique combination of constraints on joint torques, reaction forces, body postures, etc. This research focuses on one particular setup wherein a six-legged robot named SiLVIA braces itself between two vertical walls and climbs vertically with end-effectors that only use friction.

➢ Cooperated to design the optimization-based motion planner for on-wall climbing motions. Instead of planning with a single nonlinear programming (NLP) solver, the problem is decoupled into two parts: the first part is formulated as a mixed-integer convex programming (MICP) to solve contact positions and body postures while the second part solves a series of convex optimization to get feasible contact forces. With the proposed solution, the robot is capable of handling vertical walls with irregular profiles although some optimality is sacrificed.

➢ Developed a motion planner specifically for the transition phase from the ground to the wall during autonomous vertical wall climbing. Instead of using a pre-determined contact sequence for different transition setups, a nonlinear programming (NLP) via modeling contact constraints and limb switchability as complementarity conditions is used to generate various and feasible sequences of foot placements and contact forces to avoid failure cases.

A Reduced-DoF Quadruped Robot with Minimal Torque Requirements.   09/2018-06/2020

Abstract: With a unique kinematic arrangement, a new type of quadruped robot with only 9 degrees of freedom (DoF) requires minimal-torque actuators to achieve high-payload locomotion. The design significantly reduces the heating problems of traditional quadruped robots while keeping it cost-friendly with less actuators.

➢ Applied design optimization method to optimize all design parameters of the robot and finished all the CAD design, manufacturing, and assembly of the robot.

➢ Completed the unique kinematic analysis and achieve a series of successful walking gaits in the actual hardware.

Selected Publications

Journals

- Zhicheng He, Jiayang Wu, **Jingwen Zhang**, Shibowen Zhang, Yapeng Shi, Hangxin Liu, Lining Sun, Yao Su, and Xiaokun Leng. "Cdm-mpc: An integrated dynamic planning and control framework for bipedal robots jumping." IEEE Robotics and Automation Letters 9, no. 7 (2024): 6672-6679.

- Hangxin Liu, Qi Xie, Zeyu Zhang, Tao Yuan, Song Wang, Zaijin Wang, Xiaokun Leng, Zhicheng He, Yao Su, and **Jingwen Zhang** . "PR2: A Physics-and Photo-Realistic Humanoid Testbed With Pilot Study in Competition." *Journal of Field Robotics* (2025).

- Weidong Huang*, **Jingwen Zhang***, Jiongye Li, Shibowen Zhang, Jiayang Wu, Jiayi Wang, Hangxin Liu, Yaodong Yang, Yao Su. "ECO: Energy-Constrained Optimization With Reinforcement Learning for Humanoid Walking." IEEE Transactions on Automation Science and Engineering (TASE), no. 23 (2026): 4861-4876

Conference

- Weidong Huang, Zhehan Li, Hangxin Liu, Biao Hou, Yao Su, **Jingwen Zhang.** "Towards Bridging the Gap between Large-Scale Pretraining and Efficient Finetuning for Humanoid Control." 2026 International Conference

on Learning Representations (ICLR), 2026.

- **Jingwen Zhang**, Junjie Shen, Yeting Liu, and Dennis W. Hong. " Design of a Jumping Control Framework with Heuristic Landing for Bipedal Robots." 2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). IEEE, 2023.
- Junjie Shen, **Jingwen Zhang**, Yeting Liu, and Dennis W. Hong. "Implementation of a Robust Dynamic Walking Controller on a Miniature Bipedal Robot with Proprioceptive Actuation." 2022 IEEE-RAS 21st International Conference on Humanoid Robots (Humanoids). IEEE, 2022.
- Yeting Liu, Junjie Shen, **Jingwen Zhang**, Xiaoguang Zhang, Taoyuanmin Zhu, and Dennis W. Hong. "Design and control of a miniature bipedal robot with proprioceptive actuation for dynamic behaviors." 2022 International Conference on Robotics and Automation (ICRA). IEEE, 2022.
- **Jingwen Zhang**, Xuan Lin, and Dennis W. Hong. "Transition Motion Planning for Multi-Limbed Vertical Climbing Robots Using Complementarity Constraints." 2021 IEEE/RSJ International Conference on Robotics and Automation (ICRA). IEEE, 2021.
- **Jingwen Zhang**, Junjie Shen, and Dennis W. Hong. "Kinematic Analysis and Design Optimization for a Reduced-DoF Quadruped Robot with Minimal Torque Requirements." 2020 17th International Conference on Ubiquitous Robots (UR). IEEE, 2020.
- Xuan, Lin, **Jingwen Zhang**, Junjie Shen, Gabriel Fernandez, and Dennis W. Hong. "Optimization based motion planning for multi-limbed vertical climbing robots." 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). IEEE, 2019. (**IROS Best Paper Award on Safety, Security, and Rescue Robotics**)

Patent

- **Jingwen Zhang**, Weidong Huang, Xiaolong Hu, Yao Su, and Hangxin Liu. Method and System for Optimizing Action Execution of an Intelligent Agent. CN120002667B, 22 July 2025.
- Shao Yang**, Jingwen Zhang**, and Kefu Yao. A kind of ultrasonic resonance spectrometer low temperature test device. CN107422040B, 10 November 2020.

Professional Experience

06/2023 – Present   **Research Fellow at Beijing Institute for General Artificial Intelligence (BIGAI)**
- ➢ Develop task and motion planning algorithms for humanoid robots
- ➢ Combine with reinforcement learning and MPC to improve functionalities of robots

09/2021 – 03/2023   **Research Assistant at RoMeLa**
- ➢ Develop novel optimization-based control and planning algorithms for legged robots
- ➢ Design and prototype legged robots for testing and evaluating

09/2018 – 09/2021   **Teaching Fellow (promoted from Teaching Assistant) at UCLA**
- ➢ MAE101 Statics and Strength of Materials
- ➢ LIFESCI 30A/B Mathematics for Life Scientists
- ➢ PHYSICS 1A Mechanics & 5C Electricity, Magnetism, and Modern Physics

06/2019 - Present   **Paper Reviewer**
- ➢ IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
- ➢ IEEE/RSJ International Conference on Robotics and Automation (ICRA)
- ➢ The International Journal of Robotics Research (IJRR)
- ➢ IEEE Robotics and Automation Letters (RA-L)
- ➢ IEEE Transactions on Robotics (T-RO)
- ➢ ASME Journal of Mechanisms and Robotics

05/2016 - 08/2016 **Embedded Engineer Intern at Kovan Systems**

➢ Kovan Systems is a Chinese startup aiming to develop an automotive high-density storage system
➢ Optimized the algorithm of Laser Pointer in Human Work Station to improve the accuracy of pointing and the speed and position control of stepper-motors
➢ Compiled the C++ (based on Arduino) Library of Laser Pointer

Honors and Awards

2025	Associate Editor, 2025 IEEE-RAS 24th International Conference on Humanoid Robots (Humanoids)
2019	IROS Best Paper Award on Safety, Security, and Rescue Robotics
2014-2015	Academic Excellence Scholarship, Guanghua Educational Scholarship
2012-2014	Integrated Excellence Scholarship, Huangyicong Couple Scholarship for two consecutive years
2012	Outstanding Volunteer for Ecological Environmental Protection in Hoh Xil, Qinghai

Skills

Language: Chinese (native speaker), English (professional working proficiency)

Professional Skills: Solidworks (CAD and CAM), AutoCAD, C++, Python, MATLAB, Adobe Premiere Pro, Gazebo, Gurobi, CasADi, SNOPT, CVX, IPOPT, IsaacGym, MuJoCo, RL

Hobbies: Basketball, Travelling and Bartending