Yuhao Huang

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Education

University of Wisconsin-Madison Madison, WI
Master of Science in Mechanical Engineering - Research, GPA 3.625/4.0 *Aug 2023 – May 2025 (expected)*

University of Macau Macau
Bachelor of Science in Electromechanical Engineering, GPA 3.48/4.0 (top 10%) *Aug 2019 – May 2023*

Research Interest

Legged robot design and control, bipedal robotic locomotion, data-driven control, lower-limb exoskeleton, piezoelectret sensor.

Publication

[1] Zeng, Y.*, **Huang, Y.*** and Xiong, X. "Reference-Steering via Data-Driven Predictive Control for Hyper-Accurate Robotic Flying-Hopping Locomotion." submitted to *IEEE International Conference on Robotics and Automation*, 2025. (* Denotes equal contribution)

[2] Lin, X., **Huang, Y.**, et al."iWalker: Imperative Visual Planning for Walking Humanoid Robot." submitted to *IEEE International Conference on Robotics and Automation*, 2025.

[3] **Huang, Y.***, Zeng, Y.*, and Xiong, X. "STRIDE: An Open-Source, Low-Cost, and Versatile Bipedal Robot Platform for Research and Education." *IEEE-RAS International Conference on Humanoid Robots (Humanoids)*, 2024. (* Denotes equal contribution)

[4] Shi, Y., Zhang, K., Ding, S., Li, Z., **Huang, Y.**, et al. "A Self-Powered Piezoelectret Sensor based on Foamed Plastic Garbage for Monitoring Human Motions." *Nano Research*, 2023.

Research Experience

A DDPC Based Reference-Steering Framework for Locomotion July 2024 – Sept 2024
University of Wisconsin-Madison, advisor: Xiaobin Xiong *Madison, WI*

- Developed a Data-Driven Predictive Control (DDPC) based reference-steering framework for flying-hopping locomotion of PogoX. The proposed framework has greatly enhanced the height and orientation trajectories tracking accuracies during hybrid flying-hopping locomotion.
- Derived a slacked PEM-MPC formulation of DDPC for better noise robustness and computation efficiency. This formulation enables the framework to be deployed in real-time ($200Hz$) on hardware with a data set of approximately 2000 data points.
- Proposed a method for generating artificial trajectories during ground phase of hopping thus guaranteed the feasibility of the framework during ground impact. The proposed method has the potential to be generalized to a broad range of hybrid dynamical systems.
- Implemented the slacked PEM-MPC formulation in C++ using a self-developed versatile codebase for formulating sparse QP and linear MPC problems. Tested the formulated problem with OSQP and qpOASES solvers.

iWalker: Imperative Visual Planning framework for Humanoid Robot May 2024 – Sept 2024
University of Wisconsin-Madison, advisor: Xiaobin Xiong, Chen Wang *Madison, WI*

- Implemented Hybrid Linear Inverted Pendulum (H-LIP) based stepping controller with global position tracking capability to stabilize horizontal COM velocity of bipedal robot.
- Contributed to the implementation of the H-LIP based MPC step planner for step planning of humanoid robot BRUCE in 3D. The step planner is then used for the training of step planning neural network "iStepper" by using imperative learning (IL).
- Contributed to the tuning of the stepping controller and whole body controller of BRUCE.

STRIDE: A Versatile Planar Bipedal Robot Platform for Research August 2023 – July 2024
University of Wisconsin-Madison, advisor: Xiaobin Xiong *Madison, WI*

- The whole project including hardware and software is open sourced on Github: STRIDE

- Designed modular, easy-to-assemble mechanical structures for planar bipedal robot, boom, and modular terrain blocks that are capable of holding various deformable terrain materials. Mounted two propellers to the boom for generating measurable disturbances.
- Programmed Arduino for sensor data acquisition and PD-based motor control. Enhanced an C++ I^2C library in Ubuntu for IMU reading to optimize communication frequency, improve noise filtering, and increase compatibility for multi-IMU systems.
- Implemented H-LIP based stepping control for horizontal COM velocity stabilization. Developed gravity compensation and inverse kinematics based whole-body control for motion generation. Fine-tuned all control parameters on the real robot.
- Implemented an adaptive controller to update H-LIP dynamics in real-time, addressing model discrepancies between H-LIP model and robot dynamics. This significantly improved the tracking accuracy of horizontal COM velocity.
- Conducted extensive experiments to evaluate the robot's robustness to terrain disturbances and propellor disturbance forces. Demonstrated the robot's energy efficiency and identified its potential for performing design optimization researches by measuring cost of transport (COT) and energy consumption.

An Accurate and Easy-to-use Fault Diagnosis System Feb 2022 – May 2023

University of Macau, advisor: Junwen Zhong *Macau*

- Contributed to the design and fabrication of an FEP based piezoelectret self-powered soft sensor for gearbox fault diagnosis.
- Contributed to the collection of gearbox vibration signal and performed feature extraction algorithms for sensor data analysis.
- Implemented SVM and MLP for fault signal diagnosis and classification. Compared T-SNE and PCA for data dimension reduction and visualization.

A Self-Powered Piezoelectret Sensor for Human Motion Monitoring Dec 2021 – Feb 2022

University of Macau, advisor: Junwen Zhong *Macau*

- Contributed to the fabrication of self-powered piezoelectret sensors utilizing LDPE.
- Developed and implemented debouncing and human motion detection algorithms on Arduino.
- Attached the sensors to a smart chair to detect various human sitting postures and perform motion analysis.

Teaching and Intern Experience

Teaching Assistant Fall 2023, Fall 2024

University of Wisconsin-Madison *Madison, WI*

- Taught course ME231: Geometric Modeling for Design and Manufacturing for Fall 2023 and Fall 2024. The course contents include hand sketching and Solidworks techniques for engineering design.
- Led lab sessions; Held TA office hours; Graded homework and final projects.

Robot Testing Engineer June 2022 - July 2022

Shenzhen Excelland Technology Co.Ltd. *Shenzhen, China*

- Performed humidity, fatigue and static electricity tests on individual components and the entire robot. Analyzed potential flaws in the mechanical design.

Awards

Dean's Honor list

University of Macau *Macau*

- Received Dean's Honor List for 6 semesters, awarded to students with a GPA above 3.3.

Technical Skills

Mechanical Engineering: Mechanical design (Solidworks), 3D printing (Bambu Lab), Soldering
Electrical Engineering: Embedded system (sensor reading, motor control, serial communication programming), Electrical motor, Linux
Computer Science: C++, Matlab, Python, Robot Operating System (ROS2/ROS), FROST, MuJoco, OSQP
Control: DDPC, MPC, WBC, CLF-QP, PID, Simulink