Wei-Cheng Huang

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Education

University of Illinois at Urbana-Champaign   Urbana, IL
Ph.D. Student in Computer Science   Aug. 2024 – Present

University of Pennsylvania   Philadelphia, PA
M.S.E. in Robotics, GRASP Lab, GPA: 4.0/4.0   Sep. 2022 – May 2024

Shanghai Jiao Tong University   Shanghai, China
B.E. in Mechanical Engineering (Honorary Pilot Class), GPA: 3.9/4.0, Ranking: **1**/219   Sep. 2018 – Jun. 2022

Publication

[1] **Wei-Cheng Huang***, Alp Aydinoglu*, Wanxin Jin and Michael Posa. "Adaptive Contact-Implicit Model Predictive Control with Online Residual Learning." *In IEEE International Conference on Robotics and Automation (ICRA), 2024* [PDF] [Publisher] [Website]

[2] Alp Aydinoglu, Adam Wei, **Wei-Cheng Huang** and Michael Posa. "Consensus Complementarity Control for Multi-Contact MPC." *IEEE Transactions on Robotics (T-RO), 2024* [PDF] [Publisher]

[3] **Wei-Cheng Huang***, Miao Feng*, Dezhi Yang and Guoying Gu. "Low-Resistance, High-Force, and Large-ROM Fabric-Based Soft Elbow Exosuits with Adaptive Mechanism and Composite Bellows." *Science China Technological Sciences 66.1 (2023): 24-32* [PDF] [Publisher]

Research Experience

Dynamic Autonomy and Intelligent Robotics Lab, GRASP Lab   Philadelphia, PA
Graduate Research Assistant   Advisor: Prof. Michael Posa

Adaptive Contact-Implicit MPC with Online Residual Learning   Jan. 2023 – May 2024
- Proposed a real-time adaptive multi-contact model predictive control framework, which utilizes physics-based prior models to accomplish efficient online learning and adaptation for contact-rich robotic manipulation.
- Proposed a state-dependent implicit loss formulation to learn residual of hybrid dynamics modeled as Linear Complementary System. Implemented the algorithm as an adaptive module using Casadi (Python).
- Integrated Anitescu's convex contact model with real-time multi-contact MPC controller in Drake (C++). Implemented communication pipeline to integrate the adaptive module and the MPC controller.
- Validated the proposed adaptive MPC framework by conducting contact-rich robotic manipulation hardware experiments. Achieved successful manipulation of unknown objects with non-smooth surface geometries.

Consensus Complementarity Control (C3) for Multi-Contact MPC   Jan. 2024 – Jun. 2024
- Proposed a convex approximation of the nonconvex projection step in the ADMM-based C3 algorithm. Theoretically proved the approximation's limiting behavior and connection to Linear Complementarity Problems.
- Tested the performance of the C3 algorithm on multi-contact numerical examples and high dimensional contact-rich robotic manipulation tasks. Compared the optimality gap and solve time with MIQP-based approach.

Soft Robotics and Biodesign Lab, Robotics Institute   Shanghai, China
Undergraduate Research Assistant   Advisor: Prof. Guoying Gu

Design and Control of Fabric-based Soft Elbow Exosuit   Jan. 2023 – May 2024
- Designed a fabric-based soft elbow exosuit with adaptive mechanism and composite bellow. Reduced the mechanical resistance by 80.6% and improved the output torque to 207% compared with traditional exosuit.
- Designed the penumatic actuation circuit and corresponding remote control panel. Integrated control actuation with the exosuit as a lightweight wearable system for rehabilitation and assisting.

Teaching Assistantship

Teaching Assistant for MEAM 517 Control and Optimization with Applications in Robotics   2023

Learning Assistant in School of Mechanical Engineering   2019 – 2021

Honors and Awards

Outstanding Graduate of Shanghai Jiao Tong University (Top 5% in the major)	2022
National Outstanding Graduation Design	2022
Third Prize (the only two in Shanghai Jiao Tong University, top 5% nationwide)	
Academic Excellence Scholarship (at Shanghai Jiao Tong University, top 10% in the major)	2021 & 2022
National Scholarships for Students from Taiwan, Hong Kong, and Overseas Chinese	2020 & 2021
Special Award (Top 0.19%, highest level, the only in Shanghai Jiao Tong University)	
BaoSteel Scholarship (Top 0.25%, the only in School of Mechanical Engineering)	2019
Bronze prize of China Students Education Support Award (Top 10% nationwide)	2019
A+ Club of School of Mechanical Engineering (Top 3 in each major)	2019

Technical Skills

Progragmming Languages: Python, C++, MATLAB, VBA, HTML/CSS, LaTeX

Developer Tools: VS Code, PyCharm, CLion, Git, Bazel

Frameworks/Mechatronics: Linux, ROS, PyTorch, AutoCAD, Solidworks, ABAQUS, ADAMS

Extracurricular / Leadership

Volunteer for 5th Annual Learning for Dynamics & Control Conference (L4DC)	Jun. 2023
Volunteer for GRASP ROBO Master's Student Open House	Mar. 2023
A+ Club of ME	Aug. 2020 – Aug. 2021
President	Shanghai Jiao Tong Univeristy

- Organized 12 learning-assistance events for students in School of Mechanical Engineering.
- Organized 4 internal academic-experience-sharing seminars for club members.

Siyuan Commonwealth Organization	Oct. 2018 – Aug. 2020
Volunteer Teaching Team	Shanghai Jiao Tong Univeristy

- Participated in a 21-day summer volunteer teaching program in a high school in the impoverished mountainous area of Zhenyuan County, Qingyang City, Gansu Province.
- Conducted field study on local basic education construction of Zhenyuan County and prepared a 40-page, 25000-word report. Results got recognized by Bronze prize of China Students Education Support Award.