Haodi Hu

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EDUCATION

University of Southern California (USC) Aug 2021 – May 2025(Expected)
Ph.D. student in Electrical Engineering Los Angeles, CA

University of Southern California (USC) Aug 2019 – May 2021
M.S. in Electrical Engineering Los Angeles, CA

Northeast Forest University (NEFU) Sep 2015 – Jun 2019
B.S. in Electrical Engineering, Excellent Graduate Reward Harbin, China

PUBLICATIONS

- Haodi Hu, Feifei Qian. “Obstacle-Aided Path Following of A Quadrupedal Robot Through Sequential Gait Composition”. In revision, IEEE Transactions on Robotics(T-RO).
- Kaustav Chakraborty, Haodi Hu, Matthew Kvalheim, Feifei Qian. “Planning of Obstacle-aided Navigation for Multi-legged Robots using a Sampling-based Method over Directed Graphs”. IEEE Robotics and Automation Letters(RA-L), vol. 7, no. 4, pp. 8861-8868, Oct. 2022
- Haodi Hu, Guanting Dong, Peng Bo, Xing Jian, & Wenlong Song. “Method for detecting micron cracks on a magnetic rotor surface based on a support vector machine”. IEEE Access, 6, 53141-53152, Oct 2018.

WORKING PAPER

- Haodi Hu, Elliott Meeks, Feifei Qian, “Multi-robot connection towards collective obstacle field traversal”. In preparation, IEEE Robotics and Automation Letters(RA-L).

CONFERENCES & PRESENTATIONS

- Benjamin Doshna, Michelle Joyce, Haodi Hu, Feifei Qian, Simon Wilshin, Andrew Spence. "RoboPhysics inspired experiments to understand how canines move over regular obstacle arrays". Bulletin of the American Physical Society (2023).
- Haodi Hu, Elliott Meeks, Feifei Qian. "Multi-robot connection towards collective obstacle field traversal". Bulletin of the American Physical Society (2023).
- Haodi Hu, Matthew Kvalheim, and Feifei Qian. "A mode map model to predict state transitions of multi-legged robots within obstacle fields". Bulletin of the American Physical Society (2022).
- Haodi Hu, Matthew Kvalheim, Michelle Joyce, Simon Wilshin, Andrew Spence, Feifei Qian. “A Mode Map Representation to Predict Steady States and Attraction Basins for Legged Locomotion on Obstacle Terrains”. workshop in International Conference on Intelligent Robots and Systems (IROS), 2020.

ACADEMIC & PROJECT EXPERIENCE

Optimizing Robot Excavation Strategies for Navigation on an Obstacle-Dense Granular Slope Using Model-based Reinforcement Learning Aug 2023 – Present
USC

- Trained a CNN-based model to predict granular media responses to legged robot excavation actions.
- Trained a policy that enabled quadrupedal robots to explore excavation strategies to change the distribution of obstacles to assist its locomotion on a granular slope.
- Deployed the trained policy on a Quadrupedal robot in the experiment, the robot shows an ability to manipulate granular media on the slope to assist its locomotion.

Multi-robot connection towards collective obstacle field traversal Jun 2022 – Present
USC

- Proposed a multi-agent robot system to develop strategies for multiple robots cooperating to overcome locomotion challenges on different challenging terrains.
- Investigated how different robot leg-obstacle interaction patterns lead the robot to a moving state or stagnation state and applied it to an obstacle-dense terrain to help the open-loop robot generate desired movement without avoiding the interaction with obstacles.

Obstacle-aided quadrupedal robot locomotion and navigation Sep 2021 – Present

USC

- Built a simplified mathematical model based on discrete dynamics to describe quadruped robot interaction with obstacles.
- Investigated passive steady mechanism under quadrupedal robot legs repeatedly interact with obstacles and proposed a sequential gaits method to guide an open-loop control robot to achieve desired locomotion trajectories on an obstacle-dense terrain.
- Engineered an efficient computational model predicting quadruped leg-obstacle behavior, validated through experiments, enabling sensor-free robot navigation across structural obstacles using sequential gaits.
- Extended the proposed model to more randomized and natural obstacle terrains and developed a gait sequential optimizing criteria to help optimize the robot path on obstacle-dense terrains.

Cannie gait on obstacle-dense terrains Oct 2020 – Present

USC

- Helped biologists to utilize a simple mode map model to investigate canine gaits shifting patterns on an obstacle-dense terrain.
- Generated simulation results concerning canine experiment parameters and compared the simulation results with the experiment results to help uncover how canine gait negotiates with obstacles.

Computer System Organization and VLSI Design Aug 2019 –Jan 2020

USC

- Designed basic logic cells, sequential cells (D-Flipflop), Phase-locked loop and Phase Frequency Detector.
- Used Cadence to do physical layout design (Compound gate), circuit simulation, parasite extraction, and performance optimization.
- Used Verilog HDL to design logic circuits (32bit ALU, FIFO, Multi-cycle CPU, Pipeline CPU).

Design of Automatic Measuring System of Railway Electrical Equipment Limit Nov 2018 – Dec 2019

NEFU

- Proposed an innovative 3D laser scanning imaging method to improve the detection efficiency.
- Simulated and verified various imaging solutions proposed by team, including Laser imaging, magnetic imaging, acoustic imaging.

Method for detecting micron cracks on a magnetic rotor surface based on a support vector machine Oct 2017 – Mar 2018

NEFU

- Proposed a new method to detect cracks on magnetic rotor surfaces realized a maximum crack identification accuracy of 97.9%.
- Our research was founded $250,000 from the National Research Foundation and results were published in IEEE Access.

TEACHING EXPERIENCE

University of Southern California

Sep 2022 - Present

- Teaching assistant for EE541(A computational introduction to deep learning) in 2023 fall semester
- Teaching assistant for EE457(Computer Systems Organization) in 2023 summer semester
- Teaching assistant for EE541(A computational introduction to deep learning) in 2023 spring semester
- Teaching assistant for EE599(Robotics mobility) in 2022 fall semester

TECHNICAL SKILL

Programming Languages: Python, C++, Java, MATLAB

Skilled fields: Legged robot locomotion and navigation, Multi-robot cooperation, Machine learning, Mathematical modeling, Robot sensing, Embedded device