

YANRAN DING

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RESEARCH INTEREST

Legged Robots, Design, Optimization-Based Control, Trajectory Optimization, Motion Planning

EDUCATION

University of Illinois at Urbana-Champaign Dec. 2017 - present

Doctor of Philosophy Candidate, Mechanical Science and Engineering

Advisors: Dr. [Hae-Won Park](#) and Dr. [João Ramos](#)

Korean Advanced Institute of Science and Technology June 2019 - Aug. 2019

Visiting Scholar, HUBO Lab, Mechanical Engineering

University of Illinois at Urbana-Champaign Aug. 2015 - Dec. 2017

Master of Science, Mechanical Science and Engineering

Advisors: Dr. Hae-Won Park

Shanghai Jiao Tong University Sept. 2011 - Aug. 2015

Bachelor of Science, Mechanical Engineering (with honor)

Advisor: Dr. Peisen Huang

RESEARCH EXPERIENCE

Graduate Research Assistant 2015 - present

Dynamic Robotics Lab, UIUC

- Designed and built a torque-controllable quadrupedal robot *Panther* with dynamic capabilities
- Originated the Representation-Free Model Predictive Control (RF-MPC) for dynamic motions in quadrupeds, applications include extremely dynamic maneuver, wall/ceiling climbing robots
- Implemented the RF-MPC algorithm on *Panther* for Real-Time control; demonstrated the RF-MPC in experiments of various dynamic motions such as trotting, bounding, squat jumping and tumbling
- Developed a Mixed-Integer Convex Program based kino-dynamic motion planning framework, which enables dynamic single/multiple legged robots to traverse challenging terrains

Undergraduate Research Assistant 2013-2015

State Key Laboratory of Mechanical Systems and Vibration, SJTU

- Implemented a Real-Time PID control system for a piezo-actuated planar motor using LabVIEW; tuned gain values and limited motion deviation within $\pm 1 \mu m$

PUBLICATIONS

JOURNAL

9. [T-RO' 20] Yanran Ding, Abhishek Pandala, Chuanzheng Li, Young-Ha Shin, and Hae-Won Park. "Representation-Free Model Predictive Control for Dynamic Motions in Quadrupeds." *Manuscript accepted by Transactions on Robotics*, 2020.
8. [Mechatronics' 20] Chuanzheng Li, Yanran Ding, and Hae-Won Park. "Centroidal-Momentum-Based Trajectory Generation for Legged Locomotion." *Mechatronics*, 2020. [\[pdf\]](#)

7. [RA-L' 19] Abhishek Pandala, Yanran Ding, and Hae-Won Park. "qpSWIFT: A Real-time Sparse Quadratic Program Solver for Robotic Applications." *Robotics and Automation Letters*, 2019. [\[pdf\]](#)

CONFERENCE

6. [IROS' 20] Yanran Ding, Chuanzheng Li, and Hae-Won Park. "Wrench-based Kinodynamic Motion Planning for Multi-Legged Robots via Mixed-Integer Convex Program." *IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2020. (to appear)
5. [ICRA' 19] Yanran Ding, Abhishek Pandala, and Hae-Won Park. "Real-time Model Predictive Control for Versatile Dynamic Motions in Quadrupedal Robots." *International Conference on Robotics and Automation*, 2019.[\[pdf\]](#)
4. [IROS' 18] Yanran Ding, Chuanzheng Li, and Hae-Won Park. "Single Leg Dynamic Motion Planning with Mixed-Integer Convex Optimization." *IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2018.[\[pdf\]](#)
3. [IROS' 17] Yanran Ding and Hae-Won Park. "Design and Experimental Implementation of a Quasi-Direct-Drive Leg for Optimized Jumping." *IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2017.[\[pdf\]](#)
(Best Student Paper Award Finalist)

MANUSCRIPT IN PREPARATION

2. [RA-L] Yanran Ding, Mengchao Zhang, Chuanzheng Li, Kris Hauser, and Hae-Won Park. "Decoupled Planning for Legged Robot Over Challenging Terrains." *Manuscript in preparation for RA-L*, 2021.
1. [ICRA' 21] Joao Ramos, Yanran Ding, Youngwoo Sim, Kevin Murphy, and Daniel Block. "HOPPY: An open-source and low-cost kit for robotics education." *Manuscript in preparation for ICRA*, 2021.

PATENT

[\[CN104648665A\]](#). "A Linkage Mechanism for Quadrotor Power Cable Cruise ." *China*, granted Dec. 2016.

TEACHING AND MENTORING

University of Illinois at Urbana-Champaign

Teaching Assistant, ME446 Robot Dynamics and Control

2020 Spring

- Developed simulation leading to students implementing hopping controllers on a legged robot
- Delivered one lecture on inverse dynamics control and an introduction on legged robots

Teaching Assistant, ME360 Fundamentals of Signal Processing

2019 Fall

- Received rating as excellent TA by students [\[19Fall\]](#)

TA, ME340 Modeling and Analysis of Dynamical Systems

2020 Fall, 2017 Fall, 2016 Spring

- Received rating as excellent TA by students [\[17Fall\]](#) [\[16Spring\]](#)

Graduate Mentor

2016-2018

- Mentored 7 undergraduates from the Department of Mechanical Science and Engineering, UIUC. 2 of the undergraduates went on for Ph.D. study on Robotics in Georgia Tech and Princeton, respectively

Shanghai Jiao Tong University

Teaching Assistant, ME395 Engineering Laboratory

2015 Spring

- Designed and implemented laboratory experiments with the instructors on various topics

HONORS AND AWARDS

Best Robotics Demo Award , Coordinated Science Lab Student Conference, UIUC	2017,2019
Coordinated Science Laboratory Video of the month , UIUC	2019 March
Finalist of Best student paper , IROS, Vancouver	2017
Senior Design project Gold Prize, Shanghai Jiao Tong University	2015
Yu Liming Scholarship, UM-SJTU Joint Institute	2015
National Scholarship of China, Ministry of Education	2014

ACADEMIC SERVICES

- **Reviewer for the following journal:** IEEE Robotics and Automation Letters
- **Reviewer for the following conferences:** IEEE ICRA, IEEE IROS, IEEE CASE, IEEE UR

INVITED TALKS

4. “Planning and Control of Legged Robots in Challenging Terrains”, *Virtual Seminar in Robotics, Optimization, and Assistive Mobility (ROAM) Lab*, University of Notre Dame, Notre Dame, IN, 2020.
3. “Design and Control of a Quadruped Robot Panther for Highly Dynamic Motions”, *RoboGrads Fall 2020 Student Virtual Seminar*, Georgia Tech., Atlanta, GA, 2020.
2. “Design and Control of a Quadruped Robot for Dynamic Motions”, *Robotics Seminar Series*, Illinois Robotics Group, UIUC, Urbana, IL, 2019.
1. “Design, Planning and Control of a Highly Dynamic Quadrupedal Robot”, *Coordinated Science Laboratory Student Conference*, University of Illinois at Urbana-Champaign, Urbana, IL, 2019.

POSTER PRESENTATION

1. “Design and Experimental Implementation of a Proprioceptive Leg for Optimized Jumping”, *Midwest Robotics Workshop*, Toyota Technological Institute at Chicago, IL, 2018.

SKILLS

- **Programming:** MATLAB, Simulink, LabVIEW, Python
- **Softwares:** SolidWorks, Adobe Premiere, YALMIP, CasADi
- **Languages:** English (fluent), Chinese (native tongue)