

Jeeseop Kim

PH.D · POSTDOCTORAL RESEARCH ASSOCIATE

California Institute of Technology (Caltech), CA, US

☎ (+1) 540-230-0666 | ✉ jeeseop@caltech.edu | 🏠 jeeseop.com

Education

Postdoctoral Research Fellow

CALIFORNIA INSTITUTE OF TECHNOLOGY (CALTECH)

- PI: Prof. Aaron D. Ames
- Department of Mechanical and Civil Engineering

Pasadena, CA, US

Oct. 2022 - now

Ph.D. in Mechanical Engineering

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY (VIRGINIA TECH)

- Advisor: Prof. Kaveh Akbari Hamed
- Dissertation: Collaborative Locomotion of Quadrupedal Robots:
From Centralized Predictive Control to Distributed Control

Blacksburg, VA, US

Aug. 2022

M.S. in Intelligence and Information

SEOUL NATIONAL UNIVERSITY (SNU)

- Advisor: Prof. Jaeheung Park
- Thesis: Improvement of Humanoid Gait Control using Actuator Deformation Model

Seoul, South Korea

Mar. 2017

B.S. in Mechanical and Aerospace Engineering

SEOUL NATIONAL UNIVERSITY (SNU)

Seoul, South Korea

Mar. 2014

Appointments

Postdoctoral Research Fellow

CALIFORNIA INSTITUTE OF TECHNOLOGY (CALTECH)

- PI: Prof. Aaron D. Ames
- Department of Mechanical and Civil Engineering

Pasadena, CA, US

Oct. 2022 - now

Graduate Research Assistant

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY (VIRGINIA TECH)

- Advisor: Prof. Kaveh Akbari Hamed
- Department of Mechanical Engineering

Blacksburg, VA, US

Aug. 2017 - Aug. 2022

Graduate Research Assistant

SEOUL NATIONAL UNIVERSITY (SNU)

- Advisor: Prof. Jaeheung Park
- Department of Intelligence and Information

Seoul, South Korea

Jan. 2014 - July. 2017

Research Interest

My primary areas of interest in academics include robotics, control theory, optimization, dynamical systems, and machine learning. My aim is to improve upon current methods in order to create resilient and intelligent control algorithms for collaborative work. My research covers topics such as decentralized/distributed control for multi-agent systems, autonomous robot control and planning, and agile robots with a focus on safety. My goal is to develop theoretical frameworks and validate them through experiments, with the ultimate objective

of creating robust and intelligent controllers for complex hybrid dynamical systems and transferring these to real-world applications, including human-robot interaction, legged locomotion on hybrid robotic systems, and autonomous robots with safety features.

Research Experience

Caltech

Pasadena, CA, US

POSTDOCTORAL RESEARCH ASSOCIATE,

Oct. 2022 - Present

ADVANCED MECHANICAL BIPEDAL EXPERIMENTAL ROBOTICS (AMBER) LAB

- Optimal Design of humanoid with HZD
- Development of relaxation hierarchy of safety-critical controllers for mitigating contradictory safety conditions
- Development of safety-critical coordination control on cooperative legged robots

Virginia Tech

Blacksburg, VA, US

GRADUATE RESEARCH ASSISTANT,

Aug. 2017 - Aug. 2022

HYBRID DYNAMIC SYSTEMS AND ROBOT LOCOMOTION (HDSRL) LAB

- Development of layered controller for the agile locomotion of collaborative legged robots
- Development of control architecture for the locomotion of collaborative legged robots with manipulators
- Development of hierarchical controller including whole-body controller and trajectory planner for legged robots
- Design of torque-controlled humanoid

Seoul National University (SNU)

Seoul, South Korea

GRADUATE RESEARCH ASSISTANT, DYNAMIC ROBOTIC SYSTEMS (DYROS) LAB

Jan. 2014 - Jul. 2017

- Development of control algorithms to improve the stability of humanoid locomotion by compensating for hysteresis and elasticity online
- Development of a control architecture to enhance the performance of cardiopulmonary resuscitation (CPR) using a robot manipulator

Honors

AWARDS

2023	2023 IEEE ICRA Outstanding Paper Award,	<i>IEEE</i>
2022	ASME Dynamic Systems & Control Division Rudolf Kalman Best Paper Award,	<i>ASME, US</i>
2016	The Best Presentation Award,	<i>ICROS, South Kor.</i>
2016	Darpa Robotics Challenge DRC Finalist,	<i>DRC final</i>
2012	The Best Presentation Award from Bachelor Thesis,	<i>SNU, South Korea</i>

FELLOWSHIP

2017-2022	Research Assistant Scholarships,	<i>Virginia Tech, Blacksburg, VA</i>
2014-2015	Gwan-ak Scholarship,	<i>Seoul National University, South Korea</i>
2009-2010	National Scholarship,	<i>Korea Student Aid Foundation, South Korea</i>

Teaching Experience

TEACHING ASSISTANT

Virginia Polytechnic Institute and State University

Mechanical Engineering

- ME5524: Bayesian Robotics (Spring, 2019)
- ME5984: Advanced Experimental Robotics (Fall, 2018)

Seoul National University

Transdisciplinary Studies

- 493.601: Convergent Robotics Technology (Spring, 2015)
- 493.611: Dynamics and Control of Robot-Environment Interaction (Fall, 2015)

Publications & Patents

JOURNALS

- J1.** J. Kim, R. T. Fawcett, V. R. Kamidi, A. D. Ames and K. Akbari Hamed,
“Layered Control for Cooperative Locomotion of Two Quadrupedal Robots: Centralized and Distributed Approaches,”
IEEE Transactions on Robotics, Under review.
- J2.** V. R. Kamidi, J. Kim, R. T. Fawcett, A. D. Ames, and K. Akbari Hamed,
“Distributed Quadratic Programming-Based Nonlinear Controllers for Periodic Gaits on Legged Robots,”
IEEE Control Systems Letters, Vol. 6, pp. 2509-2514, Apr, 2022.
- J3.** J. Kim and K. Akbari Hamed,
“Cooperative locomotion via supervisory predictive control and distributed nonlinear controllers,”
ASME Journal of Dynamic Systems, Measurement, and Control, Vol. 144, Issue. 3, p. 031005, Mar, 2022.
- J4.** R. T. Fawcett, A. Pandala, J. Kim, and K. Akbari Hamed,
“Real-time planning and nonlinear control for quadrupedal locomotion with articulated tails,”
ASME Journal of Dynamic Systems, Measurement, and Control, Vol. 143, Issue. 7, p. 071004, Jul, 2021.
(2022 ASME DSCD Rudolf Kalman Best Paper Award)
- J5.** K. Akbari Hamed, J. Kim, A. Pandala,
“Quadrupedal locomotion via event-based predictive control and QP-based virtual constraints,”
IEEE Robotics and Automation Letters, Vol. 5, Issue. 3, pp. 4463-4470, Jul, 2020.
- J6.** J. Kim, Y. Omori, A. Sifat, and T. Furukawa,
“Adjustably designed torque controlled humanoid platform,”
International Journal of Mechanical and Production Engineering, Vol. 7, Issue. 2, pp. 52-57, May, 2019.

CONFERENCE PAPERS

- C1.** A. B. Ghansah, J. Kim, M. Tucker, and A. D. Ames,
“Humanoid Robot Co-Design: Coupling Hardware Design with Gait Generation via Hybrid Zero Dynamics,”
2023 IEEE Conference on Decision and Control (CDC 2023), Accepted to appear.
- C2.** J. Kim, J. Lee, and A. D. Ames,
“Safety-Critical Coordination for Cooperative Legged Locomotion via Control Barrier Functions,”
2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2023), Accepted to appear.

- C3.** J. Lee, **J. Kim**, and A. D. Ames,
 “Hierarchical Relaxation of Safety-critical Controllers: Mitigating Contradictory Safety Conditions with Application to Quadruped Robots,”
2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2023), Accepted to appear.
- C4.** R. T. Fawcett, L. Amanzadeh, **J. Kim**, A. D. Ames and K. Akbari Hamed,
 “Distributed Data-Driven Predictive Control for Multi-Agent Collaborative Legged Locomotion,”
2023 IEEE International Conference on Robotics and Automation (ICRA 2023), London, UK, 29 May- 02 Jun, 2023.
(2023 IEEE ICRA Outstanding Paper Award)
- C5.** V. R. Kamidi, **J. Kim**, R. T. Fawcett, A. D. Ames and K. Akbari Hamed,
 “Distributed Quadratic Programming-Based Nonlinear Controllers for Periodic Gaits on Legged Robots,”
2022 IEEE Conference on Decision and Control (CDC 2022), Cancun, Mexico, 6-9 Dec, 2022.
- C6.** **J. Kim**, Y. Omori, A. Sifat, and T. Furukawa,
 “Adjustably designed torque controlled humanoid platform,”
International Conference on Control, Automation, Robotics and Vision Engineering, Washington DC, USA, 21-22 Nov, 2018.
- C7.** **J. Kim**, M. Kim, and J. Park,
 “Improvement of humanoid walking control by compensating actuator elasticity,”
2016 IEEE/RAS International Conference on Humanoid Robotics (Humanoids 2016), Cancun, Mexico, 15-17 Nov, 2016.
- C8.** J. Jung, **J. Kim**, S. Kim, W. Kwon, S. Na, K. Kim, J. Lee, G. Suh, and J. Park,
 “Application of robot manipulator for cardiopulmonary resuscitation,”
2016 International Symposium on Experimental Robotics (ISER 2016), Tokyo, Japan, 3-6 Oct, 2016.
- C9.** **J. Kim**, M. Kim, and J. Park,
 “Improvement of humanoid gait stability using reduction gear deformation model,”
The 31st Institute of Control, Robotics and Systems (ICROS 2016), Seoul, Korea, 10-11 Mar, 2016.
(2016 Institute of Control, Robotics and Systems Best Presentation Award)

THESES

- T1.** **Jeeseop Kim**,
 “Collaborative Locomotion of Quadrupedal Robots: From Centralized Predictive Control to Distributed Control,”
 Ph.D. thesis, Virginia Tech, 2022.
- T2.** **Jeeseop Kim**,
 “Improvement of Humanoid Gait Control using Actuator Deformation Model,”
 M.S. thesis, Seoul National University, 2017.

PAPERS UNDER REVIEW & PREPRINTS

- U1.** **J. Kim**, J. Lee, and A. D. Ames,
 “Safety-Critical Coordination for Cooperative Legged Locomotion via Control Barrier Functions,”
 preprint arXiv 2023.

- U2.** J. Lee, **J. Kim**, and A. D. Ames,
“Hierarchical Relaxation of Safety-critical Controllers: Mitigating Contradictory Safety Conditions with Application to Quadruped Robots,”
preprint arXiv 2023.
- U3.** **J. Kim**, R. T. Fawcett, V. R. Kamidi, A. D. Ames and K. Akbari Hamed,
“Layered Control for Cooperative Locomotion of Two Quadrupedal Robots: Centralized and Distributed Approaches,”
preprint arXiv 2022.
- U4.** R. T. Fawcett, L. Amanzadeh, **J. Kim**, A. D. Ames and K. Akbari Hamed,
“Distributed Data-Driven Predictive Control for Multi-Agent Collaborative Legged Locomotion,”
preprint arXiv 2022.
- U5.** K. Akbari Hamed, **J. Kim**, A. Pandala,
“Quadrupedal locomotion via event-based predictive control and QP-based virtual constraints,”
preprint arXiv 2020.

PATENTS

- 1.** Apparatus for automatic cardiovascular pulmonary resuscitation, 2016.
(Korea Patent No.10-2016-0172286).
- 2-1.** Automatic cardiopulmonary resuscitation device and control method therefor, 2020.
No. 108697572B (CN Patent), No. 3409258B1 (EU Patent)
- 2-2.** Automatic cardiopulmonary resuscitation device and control method therefor, 2021.
No. US11071686B2 (US Patent)

Professional Activities

JOURNAL REVIEWER

- Robotics and Automation Letters (RA-L), IEEE
- Open Journal of Control Systems (OJCSYS), IEEE
- Journal of Dynamic Systems, Measurement and Control, ASME

CONFERENCE REVIEWER

- American Control Conference (ACC),
- International Conference on Robotics and Automation (ICRA), IEEE
- Conference on Decision and Control (CDC), IEEE
- International Conference on Intelligent Robots and Systems (IROS), IEEE/RSJ
- International Conference on Safety, Security, and Rescue Robotics (SSRR), IEEE

Invited Presentations

- P1. Collaborative Locomotion of Quadrupedal Robots: From Centralized Predictive Control to Distributed Control,**
Department of Mechanical and Civil Engineering, Control and Dynamical Systems,
AMBER Lab seminar, California Institute of Technology, Pasadena CA (virtually), May. 2022

Skills

Trained Area	(cooperative) Robotics, Legged Robot Locomotion, Optimization
Dynamic Systems Modeling	Nonlinear Systems, Hybrid Dynamical Systems, Multiagent Systems
Theory	Control Theory, Nonlinear Control, Optimal Control, Distributed Control
Optimization Tools	MATLAB Optimization Tool box, quadprog, ECOSQP, OSQP, qpSWIFT
Programming Language	MATLAB, Python, C/C++
Mechanical Design and Analysis	Unigraphics (NX), Solidworks
Circuit Design and Analysis	Autodesk Eagle, KiCad Electronics Design Automation (EDA)