

Jeeseop Kim

CONTACT INFORMATION	126 Gates-Thomas Building California Institute of Technology 1200 E California Blvd Pasadena, CA 91125	Email: jeeseop@caltech.edu Homepage: https://jeeseop.com Github: https://github.com/jeeseop Youtube: https://www.youtube.com/@jeeseop
------------------------	---	---

Appointments

Postdoctoral Scholar	Mechanical and Civil Engineering, California Institute of Technology (Caltech) Oct. 2022 - present Advisor: Prof. Aaron D. Ames
Graduate Research Assistant	Mechanical Engineering, Virginia Tech Aug. 2019 - Aug. 2022 Advisor: Prof. Kaveh Akbari Hamed Transdisciplinary Studies, Seoul National University, South Korea Jan. 2014 - Jul. 2017 Advisor: Prof. Jaeheung Park

Education

Ph.D.	Mechanical Engineering Virginia Polytechnic Institute and State University (Virginia Tech) Dissertation: Collaborative Locomotion of Quadrupedal Robots: From Centralized Predictive Control to Distributed Control Advisor: Prof. Kaveh Akbari Hamed	August, 2022
M.S.	Intelligence and Information Seoul National University, South Korea Thesis: Improvement of Humanoid Gait Control using Actuator Deformation Model Advisor: Prof. Jaeheung Park	March, 2017
B.S.	Mechanical and Aerospace Engineering Seoul National University, South Korea	March, 2014

Research Interests

Areas of Interest	My primary academic interests span robotics, control theory, optimization, dynamical systems, and machine learning. My research goal is to establish a firm foundation that extends the state-of-the-art methods for designing resilient and intelligent control algorithms for a wide range of collaborative work. This overview includes but is not limited to 1) collaborative multi-agent systems with decentralized and distributed control policies, 2) autonomous robot control and planning for various applications, 3) agile robots without compromising safety features.
------------------------------	---

My research has a clear blueprint from theoretical developments to experimental validations to achieve two specific objectives: 1) Creating algorithms to systematically design robust and intelligent controllers for high-dimensional and complex hybrid dynamical systems; and 2) Transferring the control framework into practice with a highly dynamic robot platform. These algorithms advance knowledge in the design of feedback controllers for dynamical models arising from various collaborative works that I target. The theoretical innovations also offer a unique opportunity to advance human-robot interaction, robotic legged locomotion, autonomous robot with safety features.

Honors

Awards	◇ 2023 IEEE ICRA Outstanding Paper Award	2023
	◇ ASME Dynamic Systems & Control Division Rudolf Kalman Best Paper Award	2022
	◇ The Best Presentation Award, Institute of Control, Robotics and Systems 2016	2016
	◇ Darpa Robotics Challenge DRC Finalist	2015
	◇ The Best Presentation Award from Bachelor Thesis, Seoul National University	2012
Fellowship	Research Assistant Scholarships, Virginia Tech, Blacksburg, USA	2017 - 2022
	Gwan-ak Scholarship, Seoul National University, Seoul, South Korea	2014 - 2015
	National Scholarship from Korea Student Aid Foundation, South Korea	2009 - 2010

Teaching Experience

TEACHING ASSISTANT	Mechanical Engineering, Virginia Polytechnic Institute and State University	
	ME5524: Bayesian Robotics (Spring, 2019)	
	ME5984: Advanced Experimental Robotics (Fall, 2018)	
	Transdisciplinary Studies, Seoul National University, South Korea	
	493.601: Convergent Robotics Technology (Spring, 2015)	
	493.611: Dynamics and Control of Robot-Environment Interaction (Fall, 2015)	

Publications

JOURNAL ARTICLES	[J6] 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," <i>IEEE Transactions on Robotics</i> , Accepted to appear, Sep, 2023.
	[J5] V. R. Kamidi, J. Kim , R. T. Fawcett, A. Ames, and K. Akbari Hamed, "Distributed Quadratic Programming-Based Nonlinear Controllers for Periodic Gaits on Legged Robots," <i>IEEE Control Systems Letters</i> , Vol. 6, pp. 2509-2514, Apr, 2022.
	[J4] J. Kim , and K. Akbari Hamed, "Cooperative locomotion via supervisory predictive control and distributed non-linear controllers,"

ASME Journal of Dynamic Systems, Measurement, and Control, Vol. 144, Issue. 3, p. 031005, Mar, 2022.

- [J3] 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

- [J2] 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.
- [J1] **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

- [C9] 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.
- [C8] **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.
- [C7] 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.
- [C6] 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
- 2023 IEEE ICRA Outstanding Multi-Robot Systems Paper Award Finalist
- [C5] V. R. Kamidi, **J. Kim**, R. T. Fawcett, A. 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), Accepted, Cancun, Mexico, 6-9 Dec, 2022.

- [C 4] **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.
- [C 3] **J. Kim**, M. Kim, and J. Park,
“Improvement of humanoid walking control by compensating actuator elasticity,”
International Conference on Humanoid Robots (ICHR), Cancun, Mexico, 15-17 Nov, 2016.
- [C 2] 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,”
International Symposium on Experimental Robotics (ISER), Tokyo, Japan, 3-6 Oct, 2016.
- [C 1] **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), Seoul, Korea, 10-11 Mar, 2016.

PAPERS UNDER
REVIEW &
PREPRINTS

- [U 8] **J. Kim**, J. Lee, and A. D. Ames,
“Safety-Critical Coordination of Legged Robots via Layered Controllers and Forward Reachable Set based Control Barrier Functions,” under review 2023.
 - [U 7] J. Lee, **J. Kim**, W. Ubellacker, T. G. Molnar and A. D. Ames,
“Safety-critical Control of Quadrupedal Robots with Rolling Arms for Autonomous Inspection of Complex Environments,” under review 2023.
 - [U 6] 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,” preprint arXiv 2023.
 - [U 5] **J. Kim**, J. Lee, and A. D. Ames,
“Safety-Critical Coordination for Cooperative Legged Locomotion via Control Barrier Functions,” preprint arXiv 2023.
 - [U 4] 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.
 - [U 3] **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.
 - [U 2] 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.
 - [U 1] K. Akbari Hamed, **J. Kim**, A. Pandala,
“Quadrupedal locomotion via event-based predictive control and QP-based virtual constraints,” preprint arXiv 2020.
-

THESES &
DISSERTATION

- [T 2] Jeeseop Kim
**Collaborative Locomotion of Quadrupedal Robots:
 From Centralized Predictive Control to Distributed Control**
 PhD Dissertation, Virginia Polytechnic Institute and State University, 2022.
- [T 1] Jeeseop Kim
**Improvement of Humanoid Gait Control using Actuator Deformation
 Model**
 Master Thesis, Seoul National University, South Korea, 2017.

PATENT

- [P2-2] Automatic cardiopulmonary resuscitation device and control method therefor,
 2021. No. US11071686B2 (US Patent)
- [P2-1] Automatic cardiopulmonary resuscitation device and control method therefor,
 2020. No. 108697572B (CN Patent), No. 3409258B1 (EU Patent)
- [P1] Apparatus for automatic cardiovascular pulmonary resuscitation, 2016. Korea
 Patent No.10-2016-0172286.

Professional Activities

Session Chair

- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
 Session on “Motion Control”, Detroit, MI, 2023

Journal
Reviewer

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

Conference
Reviewer

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

Invited Presentations

- [P 1] **Collaborative Locomotion of Quadrupedal Robots:
 From Centralized Predictive Control to Distributed Control**
*Department of Mechanical and Civil Engineering, Control and Dynamical Sys-
 tems,
 AMBER Lab seminar,*
 California Institute of Technology, Pasadena CA (virtually), May, 2022.

Professional Skills

Trained Area	(cooperative) Robotics, Legged Robot Locomotion, Optimization
Dynamic Sys. Modeling Theory	Nonlinear Systems, Hybrid Dynamical Systems, Multiagent Systems 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)

References available upon request

last Updated on September 26, 2023