Jeeseop **Kim**

Ph.D · Robotics/Nonlinear Systems/Optimal Control

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Education

Virginia Polytechnic Institute and State University (Virginia Tech) — *Blacksburg, VA, US*

Ph.D. in Mechanical Engineering — *Aug. 2022*

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

Seoul National University (SNU) — *Seoul, South Korea*

M.S. in Intelligence and Information — *Mar. 2017*

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

Seoul National University (SNU) — *Seoul, South Korea*

B.S. in Mechanical and Aerospace Engineering — *Mar. 2014*

Appointments

Postdoctoral Research Fellow — *Pasadena, CA, US*

California Institute of Technology (Caltech) — *Oct. 2022 - now*

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

Graduate Research Assistant — *Blacksburg, VA, US*

Virginia Polytechnic Institute and State University (Virginia Tech) — *Aug. 2017 - Aug. 2022*

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

Graduate Research Assistant — *Seoul, South Korea*

Seoul National University (SNU) — *Jan. 2014 - July. 2017*

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

Research 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.

Research Experience

Virginia Polytechnic Institute and State University (Virginia Tech)

Blacksburg, VA, US

Graduate Research Assistant, Hybrid Dynamic Systems and Robot Locomotion Lab (HDSRL)

Aug. 2017 - Aug. 2022

- 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 Laboratory (DYROS)

Jan. 2014 - Jul. 2017

- Development of control algorithms for compensating the hysteresis online for improving the locomotion stability of humanoid
- Development of control architecture for improving the cardiopulmonary resuscitation (CPR) performance with robot manipulator

Publications & Patents

Journals

1. **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.

2. 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,"
IEEE Control Systems Letters, Vol. 6, pp. 2509-2514, Apr, 2022.

3. **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.

4. 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)

5. 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.

6. **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

1. 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,"
IEEE International Conference on Robotics and Automation (ICRA), Under review.

2. 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.

3. **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.

4. **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.

5. 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.

6. **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.

Preprints

1. **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.

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.

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)

Honors

Awards

2022	**ASME Dynamic Systems & Control Division Rudolf Kalman Best Paper Award**, ASME	
2016	**The Best Presentation Award**, Institute of Control, Robotics and Systems	*South Korea*
2016	**Darpa Robotics Challenge DRC Finalist**, DRC final	
2012	**The Best Presentation Award from Bachelor Thesis**, Seoul National University	*South Korea*

Fellowship

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

Academic Services

Conference Reviewer

2022 **American Control Conference**, IEEE

2020-2022 **International Conference on Robotics and Automation (ICRA)**, IEEE

2020-2022 **Conference on Decision and Control (CDC)**, IEEE

2021-2022 **International Conference on Intelligent Robots and Systems (IROS)**, IEEE

Invited Presentations

1. **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

Teaching Experience

Teaching Assistant

Virginia Polytechnic Institute and State University *Mechanical Engineering*

- ME5524: Bayesian Robotics
- ME5984: Advanced Experimental Robotics

Seoul National University *Transdisciplinary Studies*

- 493.601: Convergent Robotics Technology
- 493.611: Dynamics and Control of Robot-Environment Interaction

Skills

Trained Area	(cooperative) Robotics, Robot Locomotion, Autonomous robots, 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, ECOSQP, OSQP, qpSWIFT
Programming	MATLAB, Python, C/C++
Design and Simulation	Unigraphics (NX), Solidworks