

Donghyun Kim

ASSISTANT PROFESSOR · UPDATE: NOV 2020

University of Massachusetts Amherst, Amherst, MA, US

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Education

University of Texas at Austin

PH.D IN MECHANICAL ENGINEERING

- Advisor: Luis Sentis
- Thesis title: Sensor-Based Robust Whole-Body Control for High Performance Legged Humanoid Robots

Austin, TX, US

Sep. 2012 - Dec. 2017

SNU (Seoul National University)

M.S. IN MECHANICAL ENGINEERING

- Advisor: Frank C. Park
- Thesis title: An Optimal Control Analysis of Human Reaching Movements

Seoul, S.Korea

Mar. 2010 - Feb. 2012

KAIST(Korea Advanced Institute of Science and Technology)

B.S. IN MECHANICAL ENGINEERING

Daejeon, S.Korea

Mar. 2003 - Aug. 2007

Research Experience

University of Massachusetts Amherst

ASSISTANT PROFESSOR

- Development of Perception based dynamic legged robot controllers
- Development of High-level decision makers using Machine learning technique
- Advancing State estimator by integrating various sensor systems

Amherst, MA, US

Jan. 2021 - Present

Massachusetts Institute of Technology

POSTDOCTORAL ASSOCIATE

- Development of Controller for dynamic quadruped locomotion involving running and jump
- Development of Software for Cheetah robot control and simulation
- State estimator study for a new contact force/ torque measurement sensor

Cambridge, MA, US

Jan. 2019 - Dec.2020

University of Texas at Austin

POSTDOCTORAL SCIENTIST

- Locomotion controller development and experiment of a passive-ankle biped robots, Mercury and DRACO.
- Co-advising graduate students and leading a locomotion research group.

Austin, TX, US

Jan. 2018 - Jan. 2019

Apptronik Systems

RESEARCHER

- Control software development for a leg testbed using new actuators, dubbed viscoelastic liquid cooled actuator.
- Adaptability tests of new control boards, dubbed axon v2, in a point-foot biped robot.

Austin, TX, US

Jun. 2017 - Aug. 2017

Park Systems

MECHANICAL ENGINEER

- Mechanical design of atomic force microscopes (AFMs)
- Project managements of new microscopes for industrial applications.
- Developments of acoustic enclosures for AFMs in bio application.

Soowon, Korea

Aug. 2007 - Oct. 2009

Honors & Awards

- 2020 **Best paper award**, IEEE Transactions on Mechatronics
- 2018 **Outstanding paper**, IEEE International Conference on Humanoid Robots
- 2016 **Finalist**, Best WBC paper award
- 2016 **Finalist**, Best WBC video award
- 2007 **Award**, Academic distinguished achievement

KAIST, Korea

Publications and Patent

JOURNALS

1. **Donghyun Kim**, Steven Jens Jorgensen, Jaemin Lee, Junhyeok Ahn, Jiawen Luo, and Luis Sentis. Dynamic Locomotion For Passive-Ankle Biped Robots And Humanoids Using Whole-Body Locomotion Control. International Journal of Robotics Research, Accepted 2020.

2. **Donghyun Kim**, Junhyeok Ahn, Orion Campbell, Nicholas Paine, and Luis Sentis. Investigations of a Robotic Testbed with Viscoelastic Liquid Cooled Actuators. *IEEE Transactions on Mechatronics*, 2018. **Best Paper Awarded**
3. **Donghyun Kim**, Ye Zhao, Gray Thomas, Benito Fernandez, and Luis Sentis. Stabilizing series-elastic point-foot bipeds using whole-body operational space control. *IEEE Transactions on Robotics*, 32(6):1362–1379, 2016.
4. **Donghyun Kim**, Cheongjae Jang, and Frank C Park. Kinematic feedback control laws for generating natural arm movements. *Bioinspiration & Biomimetics*, 9(1):016002, 2014.
5. Jianwen Luo, Yao Su, Lecheng Ruan, Ye Zhao, **Donghyun Kim**, Luis Sentis, and Chenglong Fu. Robust Bipedal Locomotion Based on a Hierarchical Control Structure. *Robotica*, 2019.

PATENT

- [1] Sangbae Kim, Meng Yee Chuah, Lindsay Epstein, **Donghyun Kim**, Juan Romero. Sensing System. US Patent, under review.

PEER-REVIEWED CONFERENCES PAPERS

1. Lindsay Epstein, Andrew SaLoutos, **Donghyun Kim**, and Sangbae Kim. Bi-Modal Hemispherical Sensors for Dynamic Locomotion and Manipulation . In *IEEE-RAS International Conference on Intelligent Robots and System (IROS)*, 2020.
2. Thomas Dudzik, Matthew Chignoli, Gerardo Bledt, Bryan Lim, Adam Miller, **Donghyun Kim**, and Sangbae Kim. Robust Autonomous Navigation of a Small-Scale Quadruped Robot in Real-World Environments. In *IEEE-RAS International Conference on Intelligent Robots and System (IROS)*, 2020.
3. **Donghyun Kim**, Daniel Carballo, Jared Di Carlo, Benjamin Katz, Gerardo Bledt, Bryan Lim, and Sangbae Kim. Vision Aided Dynamic Exploration of Unstructured Terrain with a Small-Scale Quadruped Robot. In *IEEE-RAS International Conference on Robotics and Automation (ICRA)*. IEEE, 2020.
4. Meng Yee Chuah, Lindsay Epstein, **Donghyun Kim**, Juan Romero, and Sangbae Kim. Bi-Modal Hemispherical Sensor: A Unifying Solution for Three Axis Force and Contact Angle Measurement. In *IEEE-RAS International Conference on Intelligent Robots and System (IROS)*. IEEE, 2019.
5. Junhyeok Ahn, **Donghyun Kim**, Seunghyeon Bang, Nick Paine, Luis Sentis. Control of A High Performance Bipedal Robot using Viscoelastic Liquid Cooled Actuators. In *IEEE-RAS 19th International Conference on Humanoid Robots (Humanoids)*. IEEE, 2019.
6. **Donghyun Kim**, Steven Jorgensen, Hochul Hwang, and Luis Sentis. Control Scheme and Uncertainty Considerations for Dynamic Balancing of Passive-Ankled Bipeds and Full Humanoids. In *2018 IEEE-RAS 18th International Conference on Humanoid Robots (Humanoids)*. IEEE, 2018.
7. **Donghyun Kim**, Jaemin Lee, Junhyeok Ahn, Orion Campbell, Hochul Hwang, and Luis Sentis. Computationally-Robust and Efficient Prioritized Whole-Body Controller with Contact Constraints. In *IEEE-RAS International Conference on Intelligent Robots and System (IROS)*. IEEE, 2018.
8. Junhyeok Ahn, Orion Campbell, **Donghyun Kim**, and Luis Sentis. Fast Kinodynamic Bipedal Locomotion Planning with Moving Obstacles. In *IEEE-RAS International Conference on Intelligent Robots and System (IROS)*. IEEE, 2018.
9. **Donghyun Kim**, Orion Campbell, Junhyeok Ahn, Nicholas Paine, and Luis Sentis. Investigations of Viscoelastic Liquid Cooled Actuators Applied for Dynamic Motion Control of Legged Systems. In *2017 IEEE-RAS 17th International Conference on Humanoid Robots (Humanoids)*. IEEE, 2017.
10. Jianwen Luo, Ye Zhao, **Donghyun Kim**, Oussama Khatib, Luis Sentis. Locomotion Control of Three Dimensional Passive-Foot Biped Robot Based on Whole Body Operational Space Framework. *2017 IEEE International Conference on Robotics and Biomimetics (ROBIO)*, IEEE, 2017.
11. **Donghyun Kim**, Steven Jens Jorgensen, Peter Stone, and Luis Sentis. Dynamic behaviors on the NAO robot with closed-loop whole body operational space control. In *2016 IEEE-RAS 16th International Conference on Humanoid Robots (Humanoids)*, pages 1121–1128. IEEE, 2016.
12. **Donghyun Kim**, Gray Thomas, and Luis Sentis. A method for dynamically balancing a point foot robot. In *2015 IEEE-RAS 15th International Conference on Humanoid Robots (Humanoids)*, pages 901–907. IEEE, 2015.
13. Ye Zhao, **Donghyun Kim**, Gray Thomas, and Luis Sentis. "Hybrid multi-contact dynamics for wedge jumping locomotion behaviors." In *Proceedings of the 18th International Conference on Hybrid Systems: Computation and Control*, pp. 293-294. ACM, 2015.
14. **Donghyun Kim**, Gray Thomas, and Luis Sentis. Continuous Cyclic Stepping on 3D Point-Foot Biped Robots Via Constant Time to Velocity Reversal. In *The 13th International Conference on Control, Automation, Robotics and Vision*, Singapore, December 2014.
15. **Donghyun Kim**, Ye Zhao, Gray Thomas, and Luis Sentis. Empirical Modifications to a Phase Space Planner Which Compensates for Low Stiffness Actuation in a Planar, Point-Foot, Biped Robot. In *the ASME 2014 Dynamic Systems and Control Conference*, page V001T11A001. ASME, 2014.
16. Y Zhao, **Donghyun Kim**, B Fernandez, and L Sentis. Phase space planning and robust control for data-driven locomotion behaviors. In *2013 13th IEEE-RAS International Conference on Humanoid Robots (Humanoids)*, pages 80–87. IEEE, 2013.

PRE-PRINTS

1. **Donghyun Kim**, Jared Di Carlo, Benjamin Katz, Gerardo Bledt, and Sangbae Kim. Highly Dynamic Quadruped Locomotion via Whole-Body Impulse Control and Model Predictive Control. *arXiv.org*, September 2019.
2. **Donghyun Kim**, Jaemin Lee, and Luis Sentis. Robust Dynamic Locomotion via Reinforcement Learning and Novel Whole Body Controller. *arXiv.org*, August 2017.

3. Steven Jens Jorgensen, Orion Campbell, Travis Llado, **Donghyun Kim**, Junhyeok Ahn, and Luis Sentis. Exploring Model Predictive Control to Generate Optimal Control Policies for HRI Dynamical Systems. arXiv.org, January 2017.
4. **Donghyun Kim**, Ye Zhao, Gray Thomas, and Luis Sentis. Assessing Whole-Body Operational Space Control in a Point-Foot Series Elastic Biped: Balance on Split Terrain and Undirected Walking. arXiv.org, page 2855, January 2015.

Invited Talks

IEEE International Conference on Humanoid Robots

Beijing, China

PRESENTER IN ORAL SESSION

Nov. 2018

- Introduced paper about passive-foot biped robot balance published in Humanoid 2018

IEEE International Conference on Intelligent Robots and Systems

Madrid, Spain

PRESENTER

Oct. 2018

- Introduced paper about our new whole-body controller published in IROS 2018

IEEE International Conference on Robotics and Automation

Singapore

PRESENTER FOR TRO SESSION

May. 2017

- Introduced paper published in Transactions on Robotics

IEEE International Conference on Humanoid Robots

Seoul, Korea

PRESENTER IN ORAL SESSION

Nov. 2015

- Introduced paper, "A Method for Dynamically Balancing a Point Foot Robot" published in Humanoid 2015

Dynamic Walking 2015

Ohio State University, US

PRESENTER FOR DYNAMIC WALKING

July. 2015

- Introduced methods to stabilize point-foot biped robot

Selected Media Coverage

2019	Highly Dynamic Quadruped Locomotion , https://spectrum.ieee.org/automaton/robotics/robotics-hardware/video-friday-humanoid-robot-robot-servicing-ice-cream	<i>IEEE spectrum</i>
2019	Dynamic Locomotion of DRACO Bipedal Robot , https://spectrum.ieee.org/automaton/robotics/robotics-hardware/video-friday-amazon-ceo-jeff-bezos-dexterous-robot-hands	<i>IEEE spectrum</i>
2018	Biped Robot Balancing , https://news.utexas.edu/2018/10/02/robot-masters-human-balancing-act/	<i>UT Austin News</i>
2018	Introduction of the Lab and our Biped Robot , https://www.youtube.com/watch?v=wc6BwwqRW3s	<i>KVUE News</i>
2018	Mercury robot experiment video , https://spectrum.ieee.org/automaton/robotics/robotics-hardware/video-friday-insect-inspired-flying-robot-and-more	<i>IEEE spectrum</i>
2015	Presentation in Dynamic Walking 2015 , https://spectrum.ieee.org/automaton/robotics/humanoids/video-friday-talking-humanoids-badminton-robots-boomerang-drone	<i>IEEE spectrum</i>
2015	Point-foot biped robot balancing , https://spectrum.ieee.org/automaton/robotics/robotics-hardware/video-thursday-giant-robot-duel-snake-monster-how-driverless-cars-see	<i>IEEE spectrum</i>
2014	2D point-foot biped robot walking , https://spectrum.ieee.org/automaton/robotics/diy/video-friday-ice-bucket-challenge-with-robots	<i>IEEE spectrum</i>

Teaching Experience

Bio-inspired Robotics

MIT

TEACHING ASSISTANT

Sep. - Dec. 2019/2020

- Lectures about Dynamics simulation
- Made homeworks and grading