Donghyun **Kim**

Assistant Professor · Update: December 2024

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Research Interest

My ultimate research goal is to develop quadruped and humanoid robots that can save, assist, and enhance human life. My research spans mechanism design, control, navigation, and perception, with a particular focus on establishing system-level principles that integrate robot hardware, motor control, visual sensing, and high-level decision-making.

Employment History

University of Massachusetts Amherst — *Amherst, MA, US*

Assistant Professor — *Jan. 2021 - Present*

Massachusetts Institute of Technology — *Cambridge, MA, US*

Postdoctoral Associate — *Jan. 2019 - Dec.2020*

University of Texas at Austin — *Austin, TX, US*

Postdoctoral Scientist — *Jan. 2018 - Jan. 2019*

Education

University of Texas at Austin — *Austin, TX, US*

Ph.D in Mechanical Engineering, Advisor: Luis Sentis — *Sep. 2012 - Dec. 2017*

SNU (Seoul National University) — *Seoul, S.Korea*

M.S. in Mechanical Engineering, Advisor: Frank C. Park — *Mar. 2010 - Feb. 2012*

KAIST(Korea Advanced Institute of Science and Technology) — *Daejeon, S.Korea*

B.S. in Mechanical Engineering, Advisor: Sukyung Park — *Mar. 2003 - Aug. 2007*

Grant

2024	**National Science Foundation, PI**, Rapid Perception-Based Terrain-Adaptive Agile Locomotion of a Humanoid Robot	*$ 924k*
2024	**Army Research Laboratory, Co-PI**, SPARC: Swift Preparation for Adversary-Resilient Contact through Contrastive Neurosymbolic Adaptation	*$ 1.4M*
2024	**UMass Center for Personalized Health Monitoring, Co-PI**, A Novel Bio-Inspired Exfoliation Platform for Assistive Robots	*$ 20k*
2022	**National Robotics Initiative 3.0, Co-PI**, A Novel Framework for the Hardware and Control Co-design of Dynamic Humanoid Robots with Electric Motors	*$ 1.2M*
2022	**Stanford University Restore Center Pilot Project Award, Co-PI**, Mobile Robot System to measure human kinematics in the real-world environments	*$ 30k*

Honors & Awards

2024 **Finalist - Best WBC Paper**, IEEE Whole-body control TC
2024 **Best Paper Award**, ACM Conference on Human Factors in Computing Systems (CHI)
2024 **Finalist - Best Paper Award**, International Conference on Ubiquitous Robots (UR)
2023 **Sloan Faculty Fellowship**, Sloan Foundation
2022 **Finalist - Outstanding Dynamics and Control Paper**, ICRA
2020 **Best Paper Award**, IEEE Transactions on Mechatronics
2016 **Finalist - Best WBC Paper**, IEEE Whole-body control TC
2016 **Finalist - Best WBC Video Award**, IEEE Whole-body control TC

Publications and Patent

Journals

1. Zhu, Shifan, Zixun Xiong, and **Donghyun Kim**. CEAR: Comprehensive Event Camera Dataset for Rapid Perception of Agile Quadruped Robots. IEEE Robotics and Automation Letters, 2024.

2. Jacoff, Adam, Jeongmin Jeon, Oliver Huke, Dimitrios Kanoulas, Sehoon Ha, **Donghyun Kim**, and Hyungpil Moon. Taking the First Step Toward Autonomous Quadruped Robots: The Quadruped Robot Challenge at ICRA 2023 in London [Competitions]. IEEE Robotics & Automation Magazine, 2023.
3. Zhongyang Zhang, Kaidong Chai, Haowen Yu, Ramzi Majaj, Francesca Walsh, Edward Wang, Upal Mahbub, Hava Siegelmann, **Donghyun Kim**, and Tauhidur Rahman. Neuromorphic High-Frequency 3D Dancing Pose Estimation in Dynamic Environment. Neurocomputing, 2023.
4. **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, 2020.
5. **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 Award**
6. **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. **Finalist of Best WBC Paper Award**
7. **Donghyun Kim**, Cheongjae Jang, and Frank C Park. Kinematic feedback control laws for generating natural arm movements. Bioinspiration & Biomimetics, 9(1):016002, 2014.
8. 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**, and Juan Romero. Sensing system. U.S. Patent Application 16/409,537, filed September 24, 2020.

Peer-reviewed conferences papers

1. Daniel Marew, Nisal Perera, Shangqun Yu, Sarah Roelker, and **Donghyun Kim**. A Biomechanics-Inspired Approach to Soccer Kicking for Humanoid Robots, In 2024 IEEE-RAS 23rd International Conference on Humanoid Robots (Humanoids), 2024.
2. Shangqun Yu, Nisal Perera, Daniel Marew, and **Donghyun Kim**. Learning Generic and Dynamic Locomotion of Humanoids Across Discrete Terrains, In 2024 IEEE-RAS 23rd International Conference on Humanoid Robots (Humanoids), 2024.
3. Nisal Perera, Shangqun Yu, Daniel Marew, Mack Tang, Ken Suzuki, Aidan McCormack, Shifan Zhu, Yong-Jae Kim, and **Donghyun Kim**. StaccaToe: A Single-Leg Robot that Mimics the Human Leg and Toe. In IEEE-RAS International Conference on Intelligent Robots and System (IROS), 2024.
4. Hochul Hwang, Sunjae Kwon, Yekyung Kim, and **Donghyun Kim**. Is it safe to cross? Interpretable Risk Assessment with GPT-4V for Safety-Aware Street Crossing, In 2024 International Conference on Ubiquitous Robots (UR), 2024. **Best Paper Finalist**
5. Neil Guan, Shangqun Yu, Shifan Zhu, and **Donghyun Kim**. Impedance Matching: Enabling an RL-Based Running Jump in a Quadruped Robot, In International Conference on Ubiquitous Robots (UR). IEEE, 2024.
6. Hochul Hwang, Hee-Tae Jung, Nicholas A Giudice, Joydeep Biswas, Sunghoon Ivan Lee, and **Donghyun Kim**. Towards Robotic Companions: Understanding Handler-Guide Dog Interactions for Informed Guide Dog Robot Design, In ACM Conference on Human Factors in Computing Systems (CHI), 2024. **Best Paper Award**
7. Daniel Marew, Misha Lvovsky, Shangqun Yu, Shotaro Sessions, and **Donghyun Kim**. Integration of Riemannian Motion Policy with Whole-Body Control for Collision-Free Legged Locomotion, In 2023 IEEE-RAS 22nd International Conference on Humanoid Robots (Humanoids), 2023.
8. Shifan Zhu, Zhipeng Tang, Michael Yang, Erik Learned-Miller, and **Donghyun Kim**. Event Camera-based Visual Odometry for Dynamic Motion Tracking of a Legged Robot Using Adaptive Time Surface, In IEEE-RAS International Conference on Intelligent Robots and System (IROS), 2023.
9. Hochul Hwang, Tim Xia, Ibrahima Keita, Ken Suzuki, Joydeep Biswas, Sunghoon I. Lee, and **Donghyun Kim**. System configuration and navigation of a guide dog robot: Toward animal guide dog-level guiding work. In IEEE International Conference on Robotics and Automation (ICRA), 2023.
10. Se Hwan Jeon, Sangbae Kim, **Donghyun Kim**. Real-time Optimal Landing Control of the MIT Mini Cheetah, In IEEE-RAS International Conference on Robotics and Automation (ICRA), 2022. **Finalist of Outstanding Dynamics and Control Paper Award, Finalist of Best Whole-body control Paper Award**
11. Zuoxin Tang, **Donghyun Kim**, Sehoon Ha. Learning Agile Motor Skills on Quadrupedal Robots using Curriculum Learning, In International Conference on Robot Intelligence Technology and Applications (RiTA), 2021.
12. Gabriel B Margolis, Tao Chen, Kartik Paigwar, Xiang Fu, **Donghyun Kim**, Sang bae Kim, Pulkit Agrawal. Learning to Jump from Pixels. In Conference on Robot Learning (ICoRL), 2021, Accepted.
13. Md Mahmudur Rahman, Tauhidur Rahman, **Donghyun Kim**, Mohammad Arif Ul Alam. Knowledge Transfer across Imaging Modalities Via Simultaneous Learning of Adaptive Autoencoders for High-Fidelity Mobile Robot Vision, In IEEE-RAS International Conference on Intelligent Robots and System (IROS), 2021.
14. M Chignoli, **Donghyun Kim**, E Stanger-Jones, and Sangbae Kim. The MIT Humanoid Robot: Design, Motion Planning, and Control For Acrobatic Behaviors. In IEEE-RAS International Conference on Humanoid Robots (Humanoid), 2021.

15. 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.
16. 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.
17. **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.
18. 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.
19. 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.
20. **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.
21. **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.
22. 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.
23. **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.
24. 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.
25. **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.
26. **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.
27. 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.
28. **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.
29. **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.
30. 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.

Student Awards

2024 **1st Place at TAPIA Poster Competition,** Shiven Patel, Undergraduates
2024 **UMass Amherst Rising Researcher,** Shiven Patel, Undergraduates
2024 **Robert and Deanna Hagerty Robotics Scholarship,** Hochul Hwang, Ph.D
2020 **Spaulding-Smith Fellowship,** Daniel Marew, Ph.D

Selected Media Coverage

2024	**A New Dog Learns Old Tricks**, [Magazine Online Link]	*Significant Bits Magazine*
2021	**MIT is Building a Dynamic, Acrobatic Humanoid Robot**, [Article Link]	*IEEE spectrum*
2019	**These dog-like robots do backflips and play soccer. Yes, they're adorable**, [Article Link]	*CNN Business*
2019	**Highly Dynamic Quadruped Locomotion**, [Page Link]	*IEEE spectrum*
2019	**Dynamic Locomotion of DRACO Bipedal Robot**, [Page Link]	*IEEE spectrum*
2018	**Biped Robot Balancing**, [Link]	*UT Austin News*
2018	**Aspiring engineers constructing robots for the present and future**, [Video Link]	*KVUE News*
2018	**Mercury robot experiment video**, [Link]	*IEEE spectrum*
2015	**Presentation in Dynamic Walking 2015**, [Page Link]	*IEEE spectrum*
2015	**Point-foot biped robot balancing**, [Page Link]	*IEEE spectrum*
2014	**2D point-foot biped robot walking**, [Page Link]	*IEEE spectrum*

Teaching

Advanced Robot Dynamics and Control — *University of Massachusetts Amherst*
Instructor — *Fall 2023, Fall 2024*

Make: A Hands-on introduction to physical computing — *University of Massachusetts Amherst*
Instructor — *Spring 2022, Spring 2023*

Introduction to Robotics — *University of Massachusetts Amherst*
Instructor — *Fall 2021, 2022*

Bio-inspired Robotics — *MIT*
Lecture Assistant — *Sep. - Dec. 2019/2020*