

Ayonga Hereid

ASSISTANT PROFESSOR · CYBERBOTICS LAB
MECHANICAL AND AEROSPACE ENGINEERING · THE OHIO STATE UNIVERSITY

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Academic Experience

Assistant Professor	<i>Ohio State University, Columbus</i>	2019 - PRESENT
• Department of Mechanical and Aerospace Engineering		
Postdoctoral Fellow	<i>University of Michigan, Ann Arbor</i>	2017-2018
• Department of Electrical Engineering and Computer Science		

Education

Ph.D. in Mechanical Engineering	<i>Georgia Institute of Technology</i>	2016
• Advisor: Prof. Aaron D. Ames		
M.S. in Mechanical Engineering	<i>Zhejiang University</i>	2010
• Advisor: Prof. Kai-Chen Song		
B.S. in Mechanical Engineering	<i>Zhejiang University</i>	2007

Honors and Awards

2023	CoE Innovation Superstars , The Ohio State University	<i>Columbus, Ohio</i>
2022	NSF CAREER Award , NSF	<i>Columbus, Ohio</i>
2016	Best Conference Paper Award Finalist , IEEE International Conference on Robotics and Automation (ICRA)	<i>Stockholm, Sweden</i>
2014	Best Student Paper Award , ACM International Conference on Hybrid Systems: Computation and Control (HSCC)	<i>Berlin, Germany</i>
2011	Graduate Student Scholarship , Texas A&M University	<i>College Station, Texas</i>
2008	Hua-Ye Outstanding Graduate Student Award , Zhejiang University	<i>Hangzhou, China</i>
2006	Guang-Hua Scholarship , Zhejiang University	<i>Hangzhou, China</i>

Professional Experience

Departmental Services

MAE Seminar Organization Committee, Chair in Robotics Series	2021-PRESENT
MAE PhD Qualification Exam Committee, Coordinator (System and Dynamics)	2020-PRESENT
MAE Graduate Admission Committee, Chair in Robotics Area	2019-PRESENT

Governmental Services

NIH CNNT Study Session	2023
NSF Review Panel, Foundational Research in Robotics	2023
NSF Review Panel, National Robotics Initiative	2022
NSF CAREER Award Review Panel, Foundational Research in Robotics	2022

Associate Editor

IEEE International Conference on Robotics and Automation (ICRA)	2024
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)	2020-2023
IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics	2020

Program Committee

Robotics: Science and Systems Conference (RSS)	2017-2022
Conference on Robot Learning (CoRL)	2020-2022
ACM International Conference on Hybrid Systems: Computation and Control	2019,2023

Workshop Organizer

3rd Legged Robotics Workshop at American Control Conference · <i>Towards Safe Legged Locomotion in Complex Environments: Learning, Estimation, Planning, and Autonomy</i>	2022
1st Legged Robotics Workshop at American Control Conference · <i>Challenges and Solutions for Legged Robotics</i>	2019

Peer Reviewer

Science Robotics
IEEE Transactions on Robotics (T-RO)
IEEE Transactions on Control System Technology (T-CST)
IEEE Transactions on Automatic Control (TAC)
International Journal of Robotics Research (IJRR)
IEEE Transactions on Mechatronics (Mechatronics)
Autonomous Robots
Frontiers in Robotics and AI
IEEE International Conference on Robotics and Automation (ICRA)
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
IEEE Robotics and Automation Letters (RA-L)
IEEE Control Systems Letters (L-CSS)
IEEE Conference on Decision and Control (CDC)
American Control Conference (ACC)
ACM International Conference on Hybrid Systems: Computation and Control (HSCC)
International Workshop on the Algorithmic Foundations of Robotics (WAFR)
Robotics: Science and Systems Conference (RSS)
ASME Dynamic Systems and Control Conference (DSCC)

Teaching Experience

ME 3571: Mechanical and Kinematic Design · Terms: SP 2019, AU 2021, AU 2023	<i>Ohio State University</i>
ME 3360: System Integration and Control · Terms: SP 2021, AU 2022	<i>Ohio State University</i>
ENGR 2194: Field Experience in Robotics Mentorship · Terms: SP 2022	<i>Ohio State University</i>
ME/ECE 5463: Introduction to Real Time Robotics Systems · Terms: SP 2020, AU 2020, SP 2022	<i>Ohio State University</i>

Student Mentoring

Current Advisees

Ph.D. Students

Guillermo Castillo, <i>ECE</i> (OSU Presidential Fellowship)	2019-PRESENT
Victor Paredes, <i>MAE</i> (OSU Presidential Fellowship)	2019-PRESENT
Chengyang Peng, <i>MAE</i>	2021-PRESENT
Zhaoyang Xiang, <i>MAE</i>	2021-PRESENT
Chunhui Wang, <i>MAE</i>	2022-PRESENT

Master's Students

Tianqi Wang, <i>ECE</i>	2022-PRESENT
Sean Starrett, <i>MAE</i> , (OSU University Fellowship)	2023-PRESENT
Himanshu Lodha, <i>ECE</i>	2023-PRESENT

Undergraduate Students

Sunny Agrawal, <i>CSE</i>	2023-PRESENT
Ben Wang, <i>MAE</i>	2023-PRESENT
Aditya Rampal, <i>MAE</i>	2022-PRESENT

Past Advisees

Master's Thesis Advisees

Kirtankumar Thakkar, <i>MAE</i>	5/2021
- Thesis Title: <i>Adaptive Feedback Regulator for Powered Lower-Limb Exoskeleton under Model Uncertainty</i>	
Rede Archit, <i>MAE</i>	12/2021
- Thesis Title: <i>Safe Navigation for Bipedal Robots in Static Environments</i>	
Chayapol Beokhaimook, <i>MAE</i>	12/2021
- Thesis Title: <i>Implementation of Multi-sensor Perception System for Bipedal Robot</i>	

Undergraduate Honor Thesis Advisees

Octavian Donca, <i>CSE</i>	12/2022
- Thesis Title: <i>Real-Time Navigation for Bipedal Robots in Dynamic Environments</i>	
Michael Napoli, <i>MAE</i>	08/2022
- Thesis Title: <i>Robust Balancing for Bipedal Robot via Model Predictive Control</i>	
Tom Ballas, <i>CSE</i> (Denman Undergraduate Research Forum Award)	05/2021
- Thesis Title: <i>Off-Policy Reinforcement Learning for Bipedal Robot Locomotion</i>	
Caffrey Yu, <i>MAE</i>	05/2021
- Thesis Title: <i>Global Localization of Autonomous Underwater Vehicle using Visual Odometry</i>	

Publications

Journal Articles

- [J1] B. Weng, G. A. Castillo, W. Zhang, and A. Hereid, "On the comparability and optimal aggressiveness of the adversarial scenario-based safety testing of robots," in *IEEE Transactions on Robotics*, pp. 1–20. DOI: 10.1109/TR0.2023.3267020.

- [J2] G. A. Castillo, B. Weng, W. Zhang, and A. Hereid, “Reinforcement Learning-Based Cascade Motion Policy Design for Robust 3D Bipedal Locomotion,” in *IEEE Access*, vol. 10, pp. 20 135–20 148. doi: 10 . 1109 / ACCESS . 2022 . 3151771.
- [J3] L. Krishna, G. A. Castillo, U. A. Mishra, A. Hereid, and S. Kolathaya, “Linear Policies are Sufficient to Realize Robust Bipedal Walking on Challenging Terrains,” in *IEEE Robotics and Automation Letters*, vol. 7, no. 2, pp. 2047–2054. doi: 10 . 1109 / LRA . 2022 . 3143227.
- [J4] J. P. Reher, A. Hereid, S. Kolathaya, C. M. Hubicki, and A. D. Ames, “Algorithmic Foundations of Realizing Multi-Contact Locomotion on the Humanoid Robot DURUS,” in *Algorithmic Foundations of Robotics XII*, Springer Proceedings in Advanced Robotics, K. Goldberg, P. Abbeel, K. Bekris, and L. Miller, Eds., pp. 400–415. doi: 10 . 1007 / 978 - 3 - 030 - 43089 - 4 _ 26.
- [J5] Y. Chen, A. Hereid, H. Peng, and J. Grizzle, “Enhancing the Performance of a Safe Controller Via Supervised Learning for Truck Lateral Control,” in *Journal of Dynamic Systems, Measurement, and Control*, vol. 141, no. 10. doi: 10 . 1115 / 1 . 4043487.
- [J6] O. Harib, A. Hereid, A. Agrawal, T. Gurriet, S. Finet, G. Boeris, A. Duburcq, E. Mungai, M. Masselin, A. D. Ames, K. Sreenath, and J. W. Grizzle, “Feedback control of an exoskeleton for paraplegics: Toward robustly stable hands-free dynamic walking,” in *IEEE Control Systems Magazine*, vol. 38, no. 6, pp. 61–87. doi: 10 . 1109 / MCS . 2018 . 2866604.
- [J7] A. Hereid, C. M. Hubicki, E. A. Cousineau, and A. D. Ames, “Dynamic humanoid locomotion: A scalable formulation for hzd gait optimization,” in *IEEE Transactions on Robotics*, vol. PP, no. 99, pp. 1–18. doi: 10 . 1109 / TR0 . 2017 . 2783371.
- [J8] A. Agrawal, O. Harib, A. Hereid, S. Finet, M. Masselin, L. Praly, A. D. Ames, K. Sreenath, and J. W. Grizzle, “First steps towards translating HZD control of bipedal robots to decentralized control of exoskeletons,” in *IEEE Access*, vol. 5, pp. 9919–9934. doi: 10 . 1109 / ACCESS . 2017 . 2690407.
- [J9] H. Zhao, A. Hereid, W.-l. Ma, and A. D. Ames, “Multi-contact bipedal robotic locomotion,” in *Robotica*, vol. 35, no. 5, pp. 1072–1106. doi: 10 . 1017 / S0263574715000995.
- [J10] N. T. Dantam, D. M. Lofaro, A. Hereid, P. Y. Oh, A. D. Ames, and M. Stilman, “The ach library: A new framework for real-time communication,” in *IEEE Robotics Automation Magazine*, vol. 22, no. 1, pp. 76–85. doi: 10 . 1109 / MRA . 2014 . 2356937.

Peer-Reviewed Conference Proceedings

- [C1] Y. Gao, Y. Gong, V. Paredes, A. Hereid, and Y. Gu, “Time-varying alip model and robust foot-placement control for underactuated bipedal robot walking on a swaying rigid surface,” in *American Control Conference (ACC), AACC*.
- [C2] G. A. Castillo, B. Weng, W. Zhang, and A. Hereid, “Data-driven latent space representation for robust bipedal locomotion learning,” in *Submitted to IEEE International Conference on Robotics and Automation (ICRA), 2024*.
- [C3] V. C. Paredes, D. A. Hagen, S. W. Chesebrough, D. Garagić, and A. Hereid, “Moving past point-contacts: Extending the alip model to humanoids with non-trivial feet using hierarchical, full-body momentum control,” in *Submitted to American Control Conference, 2024*.
- [C4] V. C. Paredes and A. Hereid, “Safe whole-body task space control for humanoid robots,” in *Submitted to American Control Conference, 2024*.
- [C5] B. Weng, G. A. Castillo, Y.-S. Kang, and A. Hereid, “Towards standardized disturbance rejection testing of legged robot locomotion with linear impactor: A preliminary study, observations, and implications,” in *Submitted to IEEE International Conference on Robotics and Automation (ICRA), 2024*.

- [C6] G. A. Castillo, B. Weng, W. Zhang, and A. Hereid, “Template model inspired task-space learning for robust bipedal locomotion,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2023.
- [C7] C. Peng, O. Donca, and A. Hereid, “Safe bipedal path planning via control barrier functions for polynomial shape obstacles estimated using logistic regression,” in *IEEE International Conference on Robotics and Automation (ICRA)*, 2023. DOI: 10.48550/ARXIV.2210.03704.
- [C8] R. Soni, G. A. Castillo, L. Krishna, A. Hereid, and S. Kolathaya, “Melp: Model embedded linear policies for robust bipedal hopping,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2023.
- [C9] V. Paredes and A. Hereid, “Resolved motion control for 3d underactuated bipedal walking using linear inverted pendulum dynamics and neural adaptation,” in *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2022.
- [C10] B. Weng, G. A. Castillo, W. Zhang, and A. Hereid, “On safety testing, validation, and characterization with scenario-sampling: A case study of legged robots,” in *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2022.
- [C11] G. A. Castillo, B. Weng, W. Zhang, and A. Hereid, “Robust Feedback Motion Policy Design Using Reinforcement Learning on a 3D Digit Bipedal Robot,” in *2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, ISSN: 2153-0866, Sep. 2021, pp. 5136–5143. DOI: 10.1109/IR0S51168.2021.9636467.
- [C12] L. Krishna, U. A. Mishra, G. A. Castillo, A. Hereid, and S. Kolathaya, “Learning Linear Policies for Robust Bipedal Locomotion on Terrains with Varying Slopes,” in *2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, ISSN: 2153-0866, Sep. 2021, pp. 5159–5164. DOI: 10.1109/IR0S51168.2021.9636070.
- [C13] K. Thakkar, V. Paredes, and A. Hereid, “Adaptive feedback regulator for powered lower-limb exoskeleton under model uncertainty,” in 2021.
- [C14] G. A. Castillo, B. Weng, W. Zhang, and A. Hereid, “Hybrid zero dynamics inspired feedback control policy design for 3d bipedal locomotion using reinforcement learning,” in *IEEE International Conference on Robotics and Automation (ICRA)*, IEEE, Paris, France, Jun. 2020.
- [C15] G. A. Castillo, B. Weng, W. Zhang, and A. Hereid, “Velocity regulation of 3d bipedal walking robots with uncertain dynamics through adaptive neural network controller,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, IEEE, Las Vegas, USA, Oct. 2020.
- [C16] V. C. Paredes and A. Hereid, “Dynamic locomotion of a lower-limb exoskeleton through virtual constraints based zmp regulation,” in *ASME Dynamic Systems and Control Conference*, ASME, Pittsburgh, USA, Oct. 2020.
- [C17] G. A. Castillo, B. Weng, A. Hereid, and W. Zhang, “Reinforcement learning meets hybrid zero dynamics: A case study for rabbit,” in *IEEE International Conference on Robotics and Automation (ICRA)*, IEEE, Montreal, Canada, May 2019.
- [C18] Y. Gong, R. Hartley, X. Da, A. Hereid, O. Harib, J.-K. Huang, and J. Grizzle, “Feedback control of a cassie bipedal robot: Walking, standing, and riding a segway,” in *American Control Conference (ACC)*, AACC, Philadelphia, USA, Jul. 2019.
- [C19] A. Hereid, O. Harib, R. Hartley, Y. Gong, and J. W. Grizzle, “Rapid trajectory optimization using c-frost with illustration on a cassie-series dynamic walking biped,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, IEEE, Macao, China, Nov. 2019.

- [C20] T. Gurriet, S. Finet, G. Boeris, A. Hereid, O. Harib, M. Masselin, J. Grizzle, and A. D. Ames, “Towards restoring locomotion for paraplegics: Realizing dynamically stable walking on exoskeletons,” in *2018 IEEE International Conference on Robotics and Automation (ICRA)*, IEEE, May 2018.
- [C21] S. Kolathaya, J. Reher, A. Hereid, and A. D. Ames, “Input to state stabilizing control lyapunov functions for robust bipedal robotic locomotion,” in *American Control Conference, AACC*, Mar. 2018.
- [C22] A. Hereid and A. D. Ames, “FROST: Fast Robot Optimization and Simulation Toolkit,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, IEEE/RSJ, Vancouver, Canada, Sep. 2017.
- [C23] A. Hereid, E. A. Cousineau, C. M. Hubicki, and A. D. Ames, “3D Dynamic Walking With Underactuated Humanoid Robots: A Direct Collocation Framework for Optimizing Hybrid Zero Dynamics,” in *2016 IEEE International Conference on Robotics and Automation (ICRA)*, IEEE, Stockholm, Sweden, May 2016, pp. 1447–1454. doi: 10.1109/ICRA.2016.7487279. **Best Conference Paper Award Finalists**
- [C24] A. Hereid, S. Kolathaya, and A. D. Ames, “Online Hybrid Zero Dynamics Optimal Gait Generation Using Legendre Pseudospectral Optimization,” in *55th IEEE Conference on Decision and Control (CDC)*, IEEE, Las Vegas, NV, USA, Dec. 2016, pp. 6173–6179. doi: 10.1109/CDC.2016.7799218.
- [C25] C. M. Hubicki, A. Hereid, M. X. Grey, A. L. Thomaz, and A. D. Ames, “Work Those Arms: Toward Dynamic and Stable Humanoid Walking that Optimizes Full-Body Motion,” in *IEEE International Conference on Robotics and Automation (ICRA)*, IEEE, Stockholm, Sweden, May 2016, pp. 1552–1559. doi: 10.1109/ICRA.2016.7487293.
- [C26] S. Kolathaya, A. Hereid, and A. D. Ames, “Time dependent control lyapunov functions and hybrid zero dynamics for stable robotic locomotion,” in *American Control Conference (ACC)*, AACC, Boston, MA, USA, Jul. 2016, pp. 3916–3921. doi: 10.1109/ACC.2016.7525524.
- [C27] W.-l. Ma, A. Hereid, C. M. Hubicki, and A. D. Ames, “Efficient HZD Gait Generation for Three-Dimensional Underactuated Humanoid Running,” in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, IEEE/RSJ, Daejeon, South Korea, Oct. 2016, pp. 5819–5825. doi: 10.1109/IROS.2016.7759856.
- [C28] Q. Nguyen, A. Hereid, K. Sreenath, J. W. Grizzle, and A. D. Ames, “3d dynamic walking on stepping stones with control barrier functions,” in *55th IEEE Conference on Decision and Control (CDC)*, IEEE, Las Vegas, NV, Dec. 2016, pp. 827–834. doi: 10.1109/CDC.2016.7798370.
- [C29] J. P. Reher, E. A. Cousineau, A. Hereid, C. M. Hubicki, and A. D. Ames, “Realizing Dynamic and Efficient Bipedal Locomotion on the Humanoid Robot DURUS,” in *IEEE International Conference on Robotics and Automation (ICRA)*, IEEE, Stockholm, Sweden, May 2016. doi: 10.1109/ICRA.2016.7487325.
- [C30] J. P. Reher, A. Hereid, S. Kolathaya, C. M. Hubicki, and A. D. Ames, “Algorithmic Foundations of Realizing Multi-Contact Locomotion on the Humanoid Robot DURUS,” in *The International Workshop on the Algorithmic Foundations of Robotics (WAFR)*, San Francisco, Dec. 2016.
- [C31] H. Zhao, A. Hereid, E. Ambrose, and A. D. Ames, “3D Multi-Contact Gait Design for Prostheses: Hybrid System Models, Virtual Constraints and Two-Step Direct Collocation,” in *55th IEEE Conference on Decision and Control (CDC)*, IEEE, Las Vegas, USA, Dec. 2016, pp. 3668–3674. doi: 10.1109/CDC.2016.7798821.
- [C32] A. Hereid, C. Hubicki, E. A. Cousineau, J. W. Hurst, and A. D. Ames, “Hybrid zero dynamics based multiple shooting optimization with applications to robotic walking,” in *2015 IEEE International Conference on Robotics and Automation (ICRA)*, Seattle, WA, USA, May 2015, pp. 5734–5740. doi: 10.1109/ICRA.2015.7140002.

- [C33] A. Hereid, S. Kolathaya, M. S. Jones, J. Van Why, J. W. Hurst, and A. D. Ames, “Dynamic Multi-domain Bipedal Walking with ATRIAS Through SLIP Based Human-inspired Control,” in *17th International Conference on Hybrid Systems: Computation and Control (HSCC’14)*, Berlin, Germany: ACM, Apr. 2014, pp. 263–272. DOI: 10.1145/2562059.2562143. **Best Student/Conference Paper Award**
- [C34] A. Hereid, M. J. Powell, and A. D. Ames, “Embedding of SLIP dynamics on underactuated bipedal robots through multi-objective quadratic program based control,” in *2014 IEEE 53rd Annual Conference on Decision and Control (CDC)*, IEEE, Los Angeles, CA, USA, Dec. 2014, pp. 2950–2957. DOI: 10.1109/CDC.2014.7039843.
- [C35] K. Song, C. Li, L. Ye, B. Chen, and A. Hereid, “Signal integrity optimization of MLVDS based multi-master instrument bus,” in *2014 IEEE International Symposium on Electromagnetic Compatibility (EMC)*, Aug. 2014, pp. 433–437. DOI: 10.1109/ISEMC.2014.6899011.
- [C36] N. Dantam, A. Hereid, A. Ames, and M. Stilman, “Correct software synthesis for stable speed-controlled robotic walking,” in *Proceedings of the 2013 Robotics: Science and Systems Conference IX (RSS)*, Berlin, Germany, Jun. 2013, pp. 24–28. DOI: 10.15607/RSS.2013.IX.040.
- [C37] M. J. Powell, A. Hereid, and A. D. Ames, “Speed regulation in 3d robotic walking through motion transitions between human-inspired partial hybrid zero dynamics,” in *2013 IEEE International Conference on Robotics and Automation (ICRA)*, IEEE, Karlsruhe, Germany, May 2013, pp. 4803–4810. DOI: 10.1109/ICRA.2013.6631262.

Other Online Publications

- [P1] A. Hereid, *Robotic exoskeletons transforming lives and industries*, <https://transmitter.ieee.org/robotic-exoskeletons-transforming-lives-and-industries/>, IEEE Transmitter, May 2023.
- [P2] A. Hereid, *Why household robot servants are a lot harder to build than robotic vacuums and automated warehouse workers*, <https://tinyurl.com/bder79e5>, The Conversation, Sep. 2022.
- [P3] A. Hereid, *FROST: Fast Robot Optimization and Simulation Toolkit*, <https://ayonga.github.io/frost-dev>, AMBER Lab, Feb. 2017.