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Portfolio

Carlos Gonzalez

Research Expertise

Ph.D. Candidate with 8+ years of expertise in legged locomotion. Core competencies include Model Predictive Control (MPC), nonlinear optimization, full-stack control system integration, and deployment on physical hardware. Proficient in C++, Python, and ROS/ROS2.

Education

2021–Present **Ph.D. Aerospace Engineering**
University of Texas, Austin, TX, USA — Expected May 2026
Advisor: Dr. Luis Sentis

2015–2016 **M.S. Electrical and Computer Engineering, *with distinction***
University of New Mexico, Albuquerque, NM, USA — Cumulative GPA: 3.94 / 4.00
Advisor: Dr. Meeko Oishi
Emphasis: Systems and Control

2010–2014 **B.S. Mechanical Engineering, *cum laude***
University of New Mexico, Albuquerque, NM, USA — Cumulative GPA: 3.72 / 4.00
Advisor: Dr. Ron Lumia

Work Experience

2021–Present (Aug.) **Graduate Research Assistant**, *University of Texas at Austin*, Austin, TX
Project: Research in locomotion and multi-contact planning for humanoid robots
- Develop and benchmark fast, collision-free optimization-based Whole Body Planner for humanoids
- Developed online adaptive horizon Model Predictive Control using a PyTorch-trained NN [C5]
- Validated custom whole-body controllers in MuJoCo and PyBullet simulation environments
- Developed a custom-curriculum RL controller to navigate confined spaces with a humanoid

Project: Mechatronic design of omniwheel robot with visual and force sensing capabilities
- Designed and prototyped mechanical structure of mobile robot capable of carrying a person
- Developed and open-sourced low-level code for EtherCAT devices with ROS integration [C6]

2020–2021 (Sep.)-(July) **Research Associate**, *Institute for Human & Machine Cognition*, Pensacola, FL
Projects: Legged robot controls engineer for exoskeleton Quix and humanoid robot Atlas
- Designed and implemented (in Java) push recovery and balance strategies on Atlas
- Improved force sensing and control capabilities of exoskeleton Quix
- Wrote software integration for motor control via CAN for exoskeleton Eva and humanoid Nadia

2018–2020 (July) **Research Fellow**, *Istituto Italiano di Tecnologia*, Genoa, Italy
Project: Implementation of a balance controller on the (torque-controlled) quadruped robot HyQ
- Simulated a novel balance control strategy to make HyQ balance on two point feet on Gazebo
- Implemented the controller on the real HyQ and made the robot balance on a support line
- Incorporated a motion controller to the balance controller to achieve line walking in simulation
- Submitted and presented the main simulations and experimental results in IROS [C8]

2016–2018 **Research Assistant**, *New York University*, Brooklyn, NY, USA
Project: Sensitivity analysis of balance-stability of legged systems
- Designed a computational approach to establish the balance-stability of legged robots by combining numerical optimization and motion planning algorithms, publications [C10] and [J3]
- Derived quasi-analytical solutions to quantify the changes in balance-stability of legged systems as design constraints (e.g., torque limits) change, published work in [C9]

2015–2016 **Research Assistant**, *University of New Mexico*, Albuquerque, NM, USA

Project: Hybrid system identification for prognosis of Parkinson's Disease

- Implemented and compared several state-of-the-art methods in hybrid system identification
- Derived an alternate identification approach using optimization methods for hybrid systems, showing more accurate and precise detection of submovements in Parkinson's disease patients

2014 **Research Student**, *University of New Mexico*, Albuquerque, NM, USA

Project: Control of a smart microelectromechanical material to be used as a microgripper

- Designed and presented research proposal plan to academic advisor
- Designed and performed experiments to validate the proposed approach, published work on [J4]

Software Skills

Proficient C++, Python, ROS, Git, Matlab, Simulink

Intermediate ROS2, IsaacLab, PyTorch, EtherCAT, CAN, Java, Linux, LaTeX, OnShape

Publications

Journal Papers

[J1] Seung Hyeon Bang, **Carlos Gonzalez**, Junhyeok Ahn, Nicholas Paine, and Luis Sentis "Control and evaluation of a humanoid robot with rolling contact joints on its lower body," *Frontiers in Robotics and AI*, vol. 10, 2023. [link]

[J2] Brandon Peterson, Mark Daniel, Vishnu Subra Mani, Brooke Arnold, Travis Craig, Jeremy Gines, **Carlos Gonzalez**, William Howell, Brandon Shrewsbury, Matthew Bellman, Peter Neuhaus, Robert Griffin, "Team IHMC at the 2020 Cybathlon: a user-centered approach towards personal mobility exoskeletons, *Journal of NeuroEngineering and Rehabilitation*, vol. 19, no. 103, 2022. [link]

[J3] Carlotta Mummolo, William Z. Peng, **Carlos Gonzalez**, and Joo H. Kim, "Contact-Dependent Balance Stability of Biped Robots," *Journal of Mechanisms and Robotics*, vol. 10, no. 2, p. 021009, 2018. [link]

[J4] **Carlos Gonzalez** and Ron Lumia, "An IPMC microgripper with integrated actuator and sensing for constant finger-tip displacement," *Smart Materials and Structures*, vol. 24, no. 5, p. 55011, 2015. [link]

Conference Papers

[C1] Seung Hyeon Bang, **Carlos Gonzalez**, Gabriel Moore, Dong Ho Kang, Mingyo Seo, Ryan Gupta and Luis Sentis, "RPC: A modular framework for robot planning, control, and deployment," in *IEEE/SICE International Symposium on System Integration (SII)*, 2025. [link]

[C2] **Carlos Gonzalez** and Luis Sentis, "Guiding Collision-Free Humanoid Multi-Contact Locomotion using Convex Kinematic Relaxations and Dynamic Optimization," in *IEEE-RAS 23rd International Conference on Humanoid Robots (Humanoids)*, 2024. [link]

[C3] Seung Hyeon Bang, Jaemin Lee, **Carlos Gonzalez** and Luis Sentis, "Variable inertia model predictive control for fast bipedal maneuvers," in *IEEE Conference on Decision and Control*, 2024. [link]

[C4] Mingyo Seo, Steve Han, Kyutae Sim, Seung Hyeon Bang, **Carlos Gonzalez**, Luis Sentis and Yuke Zhu, "Deep imitation learning for humanoid loco-manipulation through hu-

man teleoperation," in *IEEE-RAS 22nd International Conference on Humanoid Robots (Humanoids)*, 2023. [link]

[C5] **Carlos Gonzalez**, Seung Hyeon Bang, Po-han Li, Sandeep Chinchali, and Luis Sentis, "Learning Adaptive Horizon Maps Based on Error Forecast for Model Predictive Control," in *IEEE Conference on Decision and Control*, 2023. [link]

[C6] **Carlos Gonzalez**, Samantha Lee, Francisco Montano, Steven Ortega, Dong Ho Kang, Mehar Jaiswal, Junfeng Jiao and Luis Sentis, "Design of a Person-Carrying Robot for Contact Compliant Navigation," in *Proceedings of the ASME International Design Engineering Technical Conference*, 2023. [link]

[C7] Junhyeok Ahn, Seung Hyeon Bang, **Carlos Gonzalez**, Yuanchen Yuan, Luis Sentis, "Data-Driven Safety Verification for Legged Robots," in *IEEE-RAS International Conference on Humanoid Robots*, 2022. [link]

[C8] **Carlos Gonzalez**, Victor Barasuol, Marco Frigerio, Roy Featherstone, Darwin G. Caldwell, and Claudio Semini, "Line walking and balancing for legged robots with point feet," in *IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2020. [link]

[C9] **Carlos Gonzalez**, Carlotta Mummolo, and Joo H. Kim, "Sensitivity of balancing in legged systems under torque constraint variations," in *Proceedings of the ASME International Design Engineering Technical Conference*, 2018, pp. 1–9. [link]

[C10] Carlotta Mummolo, William Z. Peng, **Carlos Gonzalez**, and Joo H Kim, "Contact-Dependent Balance Stability of Walking Robots," in *ASME 2017 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, 2017, pp. 1–7. [link]

[C11] **Carlos Gonzalez**, Daniel Svenkeson, Diana J. Kim, Martin J. McKeown, and Meeko Oishi, "Detection of manual tracking submovements in Parkinson's disease through hybrid optimization," *IFAC-PapersOnLine*, vol. 48, no. 27, pp. 291–297, 2015. [link]

Academic Service

Conference Review: IEEE IROS (2025, 2024, 2023), IEEE RAL (2025), IEEE ICRA (2025), IEEE Humanoids (2024), IEEE BioRob (2024)