

Carlos Carrasquillo

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Education

Georgia Institute of Technology | GPA: 4.0 / 4.0

- PhD, *Robotics*
- Master of Science, *Computer Science*, Machine Learning Specialization
- Master of Science, *Aerospace Engineering*

Aug 2021 – Present

Expected May 2026
Expected May 2025
Expected May 2025

University of Florida | GPA: 3.68 / 4.0

- Bachelor of Science, *Mechanical Engineering*, Magna Cum Laude Honors
- Bachelor of Science, *Computer Engineering*, Magna Cum Laude Honors

Aug 2017 – May 2021

May 2021
May 2021

Research Experience

Graduate Research Assistant

Aug 2021 – Current

Institution: Georgia Institute of Technology, Institute for Robotics and Intelligent Machines

Location: Atlanta, GA

Lab: DART Lab and EPIC Lab

Advisors: Anirban Mazumdar, PhD, Aaron Young, PhD

Dissertation Work:

- **[Ongoing]** *Generalized Exoskeleton Control*: Creating an energetically optimal exoskeleton torque controller that generalizes across tasks. This involves: (1) extracting motion primitives from a large human biomechanics dataset. The current framework uses a Joint Autoencoder to identify discrete primitives in a small latent space. (2) Training a motion primitive classifier on exoskeleton sensor data. (3) Human-in-the-loop optimization of a parametrized biological torque controller for each motion primitive.
- **[Ongoing]** *Force-Feedback Exoskeleton Navigation*: Developed an exoskeleton controller to help humans navigate around obstacles in low visibility environments. Fractional potential fields help steer wearers away from danger zones (high potentials) and toward safe zones (low potentials). Experiments conducted in virtual reality to minimize risk of personal injury [J2]. Ongoing research involves using smartphone LiDAR and GPS to help users navigate outdoors in totally blind conditions [C3].
- **[Ongoing]** *Human Motion Planning*: Mentored a master's student in designing an integrated local (HCVO) and global (RRT*) path planner for humans navigating safely in a dynamic environment. Experiments conducted in virtual reality to minimize risk of personal injury. The game was simulated using the Unity game engine.
- **[Completed]** *Classical Exoskeleton Control*: Designed hip exoskeleton impedance controllers for lifting, level ground walking, ramp/stair ascent, etc. Experimentally validated controllers using indirect calorimetry [J1].
- **[Completed]** *Exoskeleton Mechatronics*: Developed software libraries to and PCBs to interface with exoskeleton motor controllers, and sensors. Developed communication libraries for half-duplex communication between the exoskeleton and a master computer.

Additional Work:

- **[Ongoing]** *Microprocessor Knee (MPK) Suggestion Algorithm*: Utilizing machine learning to suggest the best commercial microprocessor knee for a transfemoral amputees. This algorithm aims to assist clinicians in their evaluation in the absence of expensive laboratory equipment. Nested cross-validation was used to develop regression models to estimate patient performance in several different tasks and across several different MPKs. Predicted performance is used to suggest a knee [J3].
- **[Completed]** *Landing Aircraft Using Reinforcement Learning*: Utilized a soft-actor critic (SAC) algorithm and a tuned reward function to land an aircraft in a field. Stable-Baselines3 was used for the SAC algorithm and Gymnasium was used for the environment.
- **[Completed]** *Bioreactor Control Box*: An electronics box designed to interface with all of the necessary pumps and sensors in a closed-loop bioreactor. Control box designed to meet clean room specifications. Additional circuitry was added to step up the control voltage relay control signals. Control box external ports support 4 pumps and 3 SPI sensors. Enclosure designed in Solidworks. PCB designed in Altium Designer.



Undergraduate Research Assistant

Jan 2019 – Aug 2021

Institution: University of Florida Dept. of Mechanical and Aerospace Engineering
Location: Gainesville, FL
Lab: ADAMUS Lab
Advisor: Riccardo Bevilacqua, PhD

B.S. Thesis Work:

- *Embedded Programming*: Wrote custom C++ libraries to interface with the D3 CubeSat's IMU, antenna, radio, and GPS avionics from a BeagleBone Black microcomputer [C1].
- *Operating System Architecture Design*: Developed a C++ onboard radio framework to enable data uplink/downlink. Implemented command and data handling logic [C2].
- *Mission Operations*: Created a ground station Python application to transmit telecommands and receive downlinked data over radio.

Research Interests: Applied Machine Learning, Autonomy, Applied Controls, Optimization, Robotics

Journal Publications

- [J3] **C. Carrasquillo**, A. Bajpai, D. Iyengar, K. Collins, A. Mazumdar, A. Young. "Enhancing Human Navigation Ability Using Force-Feedback from a Lower-Limb Exoskeleton". IEEE Transactions on Haptics. 2024. (Submitted)
- [J2] **C. Carrasquillo**, S. Zhou, W. L. Childers, A. Young, K. Herrin. "A Clinical Decision-Making Algorithm for the Personalized Prescription of Microprocessor-Controlled Prosthetic Knees: An Evidence-Based Approach based on a Randomized Trial". Prosthetics and Orthotics International. 2024. (Submitted)
- [J1] A. Bajpai, **C. Carrasquillo**, J. Carlson, J. Park, D. Iyengar, K. Herrin, A. Young, A. Mazumdar. "Design and Validation of a Versatile High Torque Quasi-Direct Drive Hip Exoskeleton". IEEE Transactions on Mechatronics. 2023.

Conference Papers

- [C3] **C. Carrasquillo**, A. Young, A. Mazumdar. "Intuitive Steering Assistance from a Wearable Robotic Assistive System for Visually Impaired Navigation". International Conference on Robotics and Automation. 2024. (Submitted)
- [C2] **C. Carrasquillo**. "A Versatile and Open-Source Radio Framework for the D3 CubeSat Mission". Small Satellite Conference. 2021. (Student Competition Best Paper Honorable Mention)
- [C1] S. Buckner, **C. Carrasquillo**, M. Eloegui, R. Bevilacqua. "A Novel Approach to CubeSat Flight Software Development Using Robot Operating System (ROS)". Small Satellite Conference. 2021.

Conference Abstracts, Presentations, and Posters

- [A5] K. Herrin, **C. Carrasquillo**, S. Zhou, W. L. Childers, A. Young. "A Clinical Decision Equation for the Personalized Prescription of Prosthetic Microprocessor Knees". The American Orthotic and Prosthetic Association. September 2024. Abstract.
- [A4] **C. Carrasquillo**, K. Herrin, S. Zhou, W. L. Childers, A. Young. "Toward data driven prescription personalization of microprocessor prosthetic knees". Military Health System Research Symposium. August 2024. Abstract & Poster.
- [A3] **C. Carrasquillo**. "Towards Functional Exoskeleton Control". The National Defense Science and Engineering Graduate Fellowship Conference. July 2024. Presentation.
- [A2] **C. Carrasquillo**. "Enhancing Human Navigation Ability Using Active Wearable Exoskeletons". Sloan UCEM Conference. April 2024. Presentation.
- [A1] **C. Carrasquillo**, A. Bajpai, D. Iyengar, K. Collins, A. Mazumdar, A. Young. "Enhancing Human Navigation Ability Using an Active Wearable Exoskeleton". American Society of Biomechanics. August 2023. Abstract & Poster Talk.



Industry Experience

Computer Science / Mechanical Engineering Intern

May 2021 – May 2022

Company: Raytheon Intelligence & Space
Location: Dallas, TX
Supervisors: Chris Bender, Malia Kawamura

- *Web App Development*: Created a web application from scratch to find components on printed circuit boards by search and mouseover. Developed using MERN stack.
- *Database Management*: Created five Splunk dashboards and ~10 process programs for production-grade machinery.
- *Local App Development*: Wrote a desktop application to log and track material testing using VBA.

Teaching Experience

Vertically Integrated Projects Mentor

Aug 2021 – Current

Institution: Georgia Institute of Technology, Institute for Robotics, and Intelligent Machines
Location: Atlanta, GA
Professor: Aaron Young, PhD
Team: Robotic Human Augmentation, VR Exo Subteam

- Mentor a group of 4-6 students that support our research group.
- Teach students how to use tools for game development, biomechanics analysis, and electronics to produce, validate, and iterate on our team's exoskeletons, vibrotactile devices, and supplemental hardware.

Design and Manufacturing Lab, Senior Teaching Assistant

May 2019 – May 2021

Institution: University of Florida Dept. of Mechanical and Aerospace Engineering
Location: Gainesville, FL
Professor: Mike Braddock

- Taught small groups of 4-5 students about the principles of design for manufacturing related to competition robots.
- Performed several robot design reviews and held feedback sessions for sketches, SolidWorks models, and drawings.
- Taught students to use machine shop equipment (lathes, mills, welding, waterjets, sheet metal brakes, CNC, etc.).
- Supervised machine shop. Helped researchers and student design teams create specialty parts using shop equipment.
- Held quarterly seminars on advanced manual machining methods.
- Mentored incoming teaching assistants by helping them be more effective leaders and communicators.

Dynamics and Control Systems Design Lab, Teaching Assistant

Aug 2020 – Dec 2020

Institution: University of Florida Dept. of Mechanical and Aerospace Engineering
Location: Gainesville, FL
Professor: Prabir Barooah, PhD, Shannon Ridgeway, PhD

- Lectured before each of 6 lab sessions to educate students on how to apply their classical control systems knowledge to real-world systems.
- Helped students understand principles of system ID, implement and tune closed-loop PID controllers on microcontrollers, and implement and debug computer vision algorithms from scratch.
- Taught students how to use LabVIEW software to control actuated closed-loop control systems.

Thermal Sciences Design and Lab Teaching Assistant

Aug 2020 – Dec 2020

Institution: University of Florida Dept. of Mechanical and Aerospace Engineering
Location: Gainesville, FL



Professor: John Abbitt, PhD

- Lectured on the thermodynamics and operating principles of internal combustion engines in lecture and office hours.
- Held brainstorming and design review sessions to help students design mathematical models for internal combustion engines as part of a final project.
- Held formal in-class exam reviews.

Numerical Methods Teaching Assistant

May 2019 – Aug 2020

Institution: University of Florida Dept. of Mechanical and Aerospace Engineering

Location: Gainesville, FL

Professor: Jonathan Brooks, PhD, Georges Akiki, PhD

- Lectured on topics including iterative algorithms, linear algebra, numerical derivatives and integrals, Fourier analysis, polynomial regression, splines, etc.
- Created homework solutions, software solutions, and grading rubrics.
- Held formal in-class exam reviews.

Fellowships and Awards

Grad REACH Scholar

Aug 2024 – Current

University Center of Exemplary Mentoring (UCEM) Fellow

Aug 2023 – Current

National Defense Science and Engineering Graduate (NDSEG) Fellow

Aug 2022 – Current

Florida Academic Scholars Award

Aug 2017 – May 2021

SwampHacks VI Infinite Energy's Best Hack Award

Jan 2020

Extracurriculars

PADI Open Water Diver

July 2023 – Current

Student Pilot @ Skybound Aviation (~60 hours)

July 2023 – Current

Georgia Tech Marching Band/Drumline: Snare Drum

July 2023 – May 2024

Skills

- *CAD*: SolidWorks (CAD, FEA), Fusion 360 (CAD, CAM), Inventor (CAD)
- *Programming Languages*: Arduino, C/C++, C#, Java, JavaScript, LabVIEW, MATLAB, Python, Simulink, VBA, VHDL
- *Python Libraries*: Gymnasium, Keras, NumPy, OpenCV, OpenMDAO, Pandas, PyGame, PyTorch, ROS, TensorFlow, Tkinter
- *Technical Hardware*: Shop Equipment, (Lathes, Mills, Waterjets, Welding, etc.), Electronics Equipment, (oscilloscopes, waveform generators, microscopes, etc.), rapid prototyping
- *Certifications*: Amateur Radio Technician (KN4ZUC), SOLIDWORKS Associate, Student Pilot (~60 hours), PADI Open Water Diver
- *Personal Projects*: 12-DOF quadruped robot, 3D bioprinter, desktop lathe, MIPS CPU, websites
- *Languages*: English and Spanish



Community Involvement

2024 Georgia Tech Robotics Summer Scholars (GTRSS) Summer Camp Organizer	Jan 2024 – Current
2023 Georgia Tech Robotics Summer Scholars (GTRSS) Summer Camp Organizer	Jan 2023 – Jul 2023
Elementary School Science Fair Judge	Nov 2022, Nov 2023
Atlanta Science Festival Volunteer	Mar 2023
American Controls Conference Volunteer	Jun 2022
National Biomechanics Day Organizer	Feb 2022 - Apr 2022