Jonathan Camargo-Leyva

Robotics, Biomechatronics and Human Augmentation
Fulbright Scholar
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Education

- **PhD. in Robotics** — **Georgia Institute of Technology**
  2016 – 2021 — *Atlanta, GA. USA*
  - Ph.D. Thesis: Sensor fusion representation of locomotion biomechanics: applications in control of lower limb prostheses
    This work entails the investigation of the role of the sensory signals available from wearable sources for the recognition of locomotion intent with regards to the mode of ambulation and in concurrence with the regression of walking state in the kinematic and kinetic domains. By assessing the dynamics of terrain negotiation during community ambulation, I investigated (1) how information from different wearable sensors infer the context where locomotion occurs, and (2) how these signals relate to the biomechanics of the locomotion. Furthermore, (3) how the biomechanics and context representation can be transferred to a lower limb prosthesis, evaluating the effects of the active response to this information.
  - Exoskeleton and Prosthetic Intelligent Controls (EPIC) Lab at GeorgiaTech
  - Advisor: Aaron Young. Ph.D
  - Reading comitee: Gregory Sawicki. Ph.D., Omer Inan. Ph.D, Boris Prilutsky. Ph.D., Ye Zhao. Ph.D.

- **M. Sc. in Mechanical Engineering** — **Universidad de los Andes**
  Emphasis in dynamics of mechanical systems and computational mechanics — *Bogotá, Colombia*
  2010 – 2012
  - M. Sc. Thesis: Dynamic simulation of unmanned aerial vehicle based on CFD.
  - Advisors: Omar Darío López Mejía. Ph.D , Nicolás Ochoa Lleras. M.Sc.
    A tool that simulates rigid body dynamics (RBD) with 6DOF loosely coupled with computational fluid dynamics (CFD) using OpenFOAM®. A feedback controller was implemented in Matlab to command the movement of vehicle control surfaces while the CFD domain adapts to the new surfaces by using mesh deformation techniques.

- **Bachelor's Degree in Mechanical Engineering** — **Universidad de los Andes**
  2004 – 2010 — *Bogotá, Colombia*
  - Final Project: Prehensile robotic hand controlled by mechanomyography signal.
  - Advisor: Ana María Polanco Gutierrez. M.Sc.
    Design of an under-actuated grasping hand. An electronic circuit was designed to process muscle sounds in order to identify contraction. Action in the flexor muscle was used to produce closing movement on the prototype.

- **Bachelor's Degree in Electronics Engineering** — **Universidad de los Andes**
  2005 – 2013 — *Bogotá, Colombia*
  - Final Project: Design of a node for wireless sensor network (WSN).
  - Advisor: Fredy Enrique Segura Quijano. Ph.D.
    A wireless sensor node was designed and produced. The node is capable of creating a measurement network, also gathering data and sending it to a web server via GSM.

Work Experience

- **Visiting Researcher**

  Researcher for the sensing and tracking team in Reality Labs under the supervision of Taylor Niehues. Ph.D.
  Wearable technology and motion tracking applied to VR/AR systems.

  Meta | Reality Labs
  Redmond, WA. USA.
  August 2021 - (Current job)

- **Graduate Research Assistant**

  Georgia Institute of Technology
  Atlanta, GA. USA.
  August 2016 - August 2021

  Exoskeleton and Prosthetic Intelligent Controls (EPIC) Lab
  Prof. Aaron Young, PhD.
  - Design updates and manufacturing of an active lower-limb prosthesis
  - Development of the impedance control software and user interface for tuning of control parameters
  - Research on intelligent models for automatic assistance during locomotion in exoskeletons and prostheses
  - Supervise and mentoring students affiliated with EPIC lab as Graduate Student Mentor for the VIP consortium team: "Robotic Human Augmentation"

- **Ph.D. Intern - Soft robotics**

  Facebook | Reality Labs
  Redmond, WA. USA. (Remote)
  December 2020 - May 2021

  Research intern at Facebook Reality Labs under the supervision of Taylor Niehues. Ph.D.
  - Evaluation of hand tracking algorithms for VR/AR systems.

- **Lecturer**

  Georgia Institute of Technology
  Atlanta, GA. USA.
  January 2020 - May 2020

  Capstone Design (ME4182 Undergraduate level final year course) Under the supervision of Prof. Gregory Sawicki. Ph.D. and Prof. Aaron Young. Ph.D. for Ph.D. Teaching practicum.
  -Preparation of materials and lecturing classes about control theory oriented to applications of machine design in the capstone projects.

- **Graduate Teaching Assistant**

  Georgia Institute of Technology
  Atlanta, GA. USA.
  January 2018 - December 2019

  Mechatronics (ME6405 - Graduate level) Under the supervision of Prof. Jonathan Rogers Ph.D.
  -Preparation of teaching materials and conducting training sessions in the laboratory
  -Teaching the use of electronic hardware and interfacing and programming with the TI-MSP432 microcontroller

- **Visiting Professor**

  Universidad de los Andes
  Bogotá, Colombia.
  June 2017

  3D Printing (IMEC3501 - Impresión 3D)
  - Undergraduate summer course on 3D printing.
  - Overview of additive manufacturing techniques, design considerations, open-hardware and open-source FDM printing.
  - Hands-on projects and activities, from the fundamentals of stepper control to the development of 3D printing machines by the students.

- **Instructor**

Universidad de los Andes
Bogotá, Colombia.
August 2013 - July 2016

Graphic Design In Engineering (IMEC1503)
First year course in Mechanical Engineering.
-Teach the use of tools and techniques of drawing and computer aided design (CAD).
-Supervise graduate assistants in charge of the drawing laboratory.

Experimentation Fundamentals (IMEC1001)
First year course in Mechanical Engineering.
-Teach experiment design and implementation with emphasis in sensors and instrumentation.
-Designed and developed the lab activities for all the sections of the course.

Machine Dynamics (IMEC2543)
Third year course in Mechanical Engineering.
-Teaching analysis and synthesis of mechanisms.

ROBOCOL Faculty advisor.
-Robocol is the Uniandes' robotics student group. The group develops activities to promote robotics in Colombia.
-Mechanical design advisor and financial control.

Faculty advisor for Mechanical Engineering Undergraduate final degree projects

- **Adjunct Instructor of Graphic Design in Engineering**

Universidad de los Andes
Bogotá, Colombia.
February 2012 - May 2013

First year course in Mechanical Engineering.
-Teach the use of tools and techniques of drawing and computer aided design (CAD).

- **Independent Consultant**

Gabriel de Colombia S.A.
Bogotá, Colombia.
December 2012

Designed and fabricated a circuit board for strain-gauge processing in a suspension test bench.

- **Research Assistant - Mechanical Engineering Department**

Universidad de los Andes
Bogotá, Colombia.
February 2010 - November 2012

Researcher in the Aerial Munition and Intelligent Systems program (MASI) under the supervision of Prof. Luis Ernesto Muñoz. Ph.D. and Prof. Carlos Francisco Rodriguez. Ph.D.
Designed and implemented an electronic board for explosion fragment's velocity measurement.
-Designed and executed test procedures for explosion effect determination.
-Developed of a computational tool for CFD simulation coupled with rigid body dynamics and control.
-Computed the aerodynamic coefficients of aerial munition.

- **Undergraduate Teaching Assistant for the Thermodynamics II Course - Mechanical Engineering Department**

Universidad de los Andes
Bogotá, Colombia.
May 2009 - August 2009

Under the supervision of Prof. Jacqueline Cantillo
-Prepared review sessions for students.
-Graded homeworks and laboratory activities.

- **Undergraduate Teaching Assistant for the Experimental Engineering Course - Mechanical Engineering Department**

Universidad de los Andes
Bogotá, Colombia.
August 2008 - May 2009

Under the supervision of Prof. Jaime Loboguerrero Ph.D. and Prof. Juan Carlos Briceño Ph.D.
-Prepared review sessions for students.
-Planned, implemented and graded laboratory workshops.
-Assisted in planning and grading homeworks and activities.

Languages

Spanish(Native) **English**(Fluent) **French**(Conversational) **Japanese**(Beginner)

Skills

- **Software Expertise**
  - Robotics and AI: PyTorch, sklearn, ROS.
  - Mechanical design CAD/CAE with Autodesk Inventor and Fusion, rendering and animation Blender.
  - FVM/FEM simulation: OpenFOAM, Ansys.
  - Electrical design and simulation: Altium, Autodesk Eagle
  - System modeling: Matlab, Mathematica,.
  - Programming languages: C++, Python, JavaScript

- **Lab expertise**
  - Motion capture and Metabolics: Vicon, Parvo.
  - Bioinstrumentation: EMG, EEG, electrogoniometers and IMU.
  - Manufacturing: operation of CNC and conventional drilling and turning machines and tools. Fabrication of printed circuit boards. Additive manufacturing FDM, SLA.

Journal Articles

- **"Predicting biological joint moment during multiple ambulation tasks"**
  Journal of Biomechanics
  Camargo, Jonathan; Molinaro, Dean; Young, Aaron
  10.1016/j.jbiomech.2022.111020

- **"Subject-Independent, Biological Hip Moment Estimation during Multimodal Overground Ambulation using Deep Learning"**
  IEEE Transactions on Medical Robotics and Bionics
  Molinaro, Dean; Kang, Inseung; Camargo, Jonathan; Gombolay Matthew, Young, Aaron
  10.1109/TMRB.2022.3144025

- **"Evaluation of Continuous Walking Speed Determination Algorithms and Embedded Sensors for a Powered Knee Ankle Prosthesis"**
  IEEE Robotics and Automation Letters (RA-L)
  Bhakta, Krishan; Camargo, Jonathan; Compton, William; Herrin, Kinsey; Young, Aaron
  10.1109/LRA.2021.3068711

- **"A Machine Learning Strategy for Locomotion Classification and Parameter Estimation Using Fusion of Wearable Sensors"**
  IEEE Transactions on Biomedical Engineering
  Camargo, Jonathan; Flanagan, Will; Csomay-Shanklin, Noel; Kanwar, Bharat; Young, Aaron
  10.1109/TBME.2021.3065809

- **"A Comprehensive, Open-source Dataset of Lower Limb Biomechanics in Multiple Conditions of Stairs, Ramps, and Level-ground Ambulation and Transitions."**
  Journal of Biomechanics
  Camargo, Jonathan; Ramanathan, Aditya; Flanagan, Will; Young, Aaron
  10.1016/j.jbiomech.2021.110320

- **"Automated Gap-filling for Marker-based Biomechanical Motion Capture Data"**
  Computer Methods in Biomechanics and Biomedical Engineering, 2020
  Camargo, Jonathan, Ramanathan, Aditya. Csomay-Shanklin, Noel. 2020
  10.1080/10255842.2020.1789971

- **"Machine Learning Model Comparisons of User Independent and Dependent Intent Recognition Systems for Powered Prostheses"**
  IEEE Robotics and Automation Letters. 2020
  Bhakta, Krishan. Camargo, Jonathan. Donovan, Luke. Herrin, Kinsey. Young, Aaron.
  10.1109/LRA.2020.3007480

- **"Impedance Control Strategies for Enhancing Sloped and Level Walking Capabilities for Individuals with Transfemoral Amputation Using a Powered Multi-Joint Prosthesis"**
  J. Military Medicine. 2019
  Bhakta, Krishan; Camargo, Jonathan; Kunapuli, Pratik; Childers, Lee; Young, Aaron
  10.1093/milmed/usz229

- **"Feature selection and non-linear classifiers: effects on simultaneous motion recognition in upper limb"**
  IEEE Transactions on Neural Systems and Rehabilitation Engineering. 2019
  Camargo, Jonathan; Young, Aaron
  10.1109/TNSRE.2019.2903986

Peer-Reviewed Conference Articles

- **"Biological Hip Torque Estimation Using a Robotic Hip Exoskeleton"**
  IEEE RAS/EMBS International Conference for Biomedical Robotics and Biomechatronics. 2020
  Molinaro, Dean; Kang, Inseung; Camargo, Jonathan; Young, Aaron
  10.1109/BioRob49111.2020.9224334

- **"Real Time Pattern Recognition for Prosthetic Hands"**
  Proceedings of the ASME International Mechanical Engineering Congress and Exposition. 2019
  Benitez, Mario; Rodriguez, Carlos F.; Camargo, Jonathan
  10.1115/IMECE2019-11788

- **"Stochastic Optimization of Impedance Parameters for a Powered Prosthesis Using a 3D Simulation Environment"**
  Proceedings of the ASME Dynamic Systems and Control Conference. 2018
  Camargo, Jonathan; Bhakta, Krishan; Young, Aaron
  10.1115/DSCC2018-9206

- **"Control and Experimental Validation of a Powered Knee and Ankle Prosthetic Device"**
  Proceedings of the ASME Dynamic Systems and Control Conference. 2018
  Bhakta, Krishan; Camargo, Jonathan; Young, Aaron
  10.1115/DSCC2018-9218

- **"Combined Strategy of Machine Vision with a Robotic Assistant for Nail Biting Prevention"**
  Proceedings of the 14th Conference on Computer and Robot Vision (CRV). 2017
  Camargo, Jonathan; Young, Aaron
  10.1109/CRV.2017.57

- **"Dynamic Characterization of a Bi-stable Laminate for Vibrational Energy Harvesting"**
  Proceedings of the 2016 XXI Symposium on Signal Processing, Images and Artificial Vision (STSIVA)
  Monsalve, Jorge; Camargo, Jonathan
  10.1109/STSIVA.2016.7743359

- **"A computational tool for unsteady aerodynamic flow simulations coupled with rigid body dynamics and control"**
  Proceedings of the 30th AIAA Applied Aerodynamics Conference 2012
  Camargo, Jonathan; López, Omar; Ochoa, Nicolás
  10.2514/6.2012-3034

Book Chapters and Theses

- **"Experimental method for explosion effect determination"**
  Design and Analysis of Materials and Engineering Structures. Chap 10.
  Camargo, Jonathan; Muñoz, Luis Ernesto.
  Ed. Springer. ISBN 978-3-642-32295-2. Berlin, Germany, 2013.

- **"Real-time Pattern Recognition for Prosthetic Hand"** (Master's Thesis)
  Benitez, Mario; Rodríguez Carlos F.; Camargo, Jonathan
  Universidad de los Andes. Bogotá, Colombia. 2019

- **"Dynamic Simulation of Unmanned Aerial Vehicle Based on CFD"** (Master's Thesis)
  "Simulación Dinámica de Vehículo Aéreo no Tripulado Basada en CFD"
  Camargo, Jonathan; López, Omar; Ochoa-Lleras, Nicolás;
  Universidad de los Andes. Bogotá, Colombia. 2012

- **"Design of a Node for Wireless Sensor Networks (WSN)"** (Bachelor's Thesis)
  "Diseño de un Nodo para Red de Sensores Inalámbricos"
  Camargo, Jonathan; Segura, Fredy;
  Universidad de los Andes. Bogotá, Colombia. 2012

- **"Prehensile Robotic Hand Controlled by a Mechanomyography Signal"** (Bachelor's Thesis)
  "Mano Robótica Prensil Controlada por Señal Mecanomiográfica"
  Camargo, Jonathan; Polanco, Ana M.;
  Universidad de los Andes. Bogotá, Colombia. 2009

Conferences, Workshops and Symposia

- **"A pilot study comparison of patient reported outcomes following use of a powered knee ankle prosthesis and clinically prescribed passive prosthesis on variable terrains"**
  American Academy of Orthotists and Prosthetists. Annual Meeting and Sci. Symp. 2021 *Virtual Event*
  Herrin, Kinsey; Bhakta, Krishan; Camargo, Jonathan; Young, Aaron

- **"Robust Automated Gap-Filling for Marker-Based Biomechanical Motion Capture Data"**
  Biomedical Engineering Society Conference 2019 *Philadelphia, PA, USA.*
  Ramanathan, Aditya; Camargo, Jonathan

- **"Effect of Experimental Powered Prosthesis on Hip Kinetics: A single Case Pilot Study"**
  45th Meeting of the American Academy of Orthotists and Prosthetists. 2019 *Orlando, FL, USA.*
  Bhakta, Krishan; Camargo, Jonathan; Spencer, Maximillian; White, Brian; Cho, Noah; Herrin, Kinsey; Childers, Lee; Young, Aaron

- **"The Value of EMG for Estimating Continuous Locomotion Parameters During Human Ambulation"**
  Biomedical Engineering Society Conference 2018 *Atlanta, GA, USA.*
  Flanagan, Will; Camargo, Jonathan

- **"Muscle synergies in simultaneous movement of upper limb"**
  International Conference of the IEEE Engineering in Medicine and Biology 2018 *Honolulu, HI, USA.*
  Camargo, Jonathan; Young, Aaron

- **"Sensor Fusion for Continuous Walking Speed Estimation on Powered Prostheses"**
  Dynamic Walking 2018 *Pensacola, FL, USA.*
  Camargo, Jonathan; Bhakta, Krishan; Young, Aaron

- **"Continuous Walking Speed Estimation using Neural Networks and Multi-Sensor Data Fusion"**
  International Conference of the IEEE Engineering in Medicine and Biology 2018 *Honolulu, HI, USA.*
  Camargo, Jonathan; Csomay-Shanklin, Noel; Kanwar, Bharat; Young, Aaron

- **"Powered knee/ankle prostheses for improving walking capabilities in individuals with transfemoral amputation"**
  Military Health System Research Symposium 2018 *Kissimmee, FL, USA.*
  Young, Aaron; Bhakta, Krishan; Camargo, Jonathan; Childers, Lee

- **"Design, fabrication and implementation of neumatic deformable actuators"**
  VII Congreso Internacional de Ingeniería Mecánica (CIMM). *Cartagena, Colombia*
  Porras, Daniel;Camargo, Jonathan
  Presentation. 29 April 2015.

- **"Teleoperation of a Stewart platform"**
  VIII Congreso de la asociación Colombiana de Automática (ACA). *Cartagena, Colombia*
  Camargo, Jonathan; Barreto, Juan Pablo.
  Presentation. 26 July 2008.

- **"Experimental method for explosion effect determination"**
  V International Conference on Advanced Computational Engineering
  and Experimenting (ACE-X). *Algarve, Portugal*
  Camargo, Jonathan; Muñoz, Luis Ernesto.
  Presentation. 3-6 July. 2011.

- **"A computational tool for unsteady aerodynamic flow simulations coupled with rigid body dynamics and control"**
  42nd AIAA Fluid Dynamics Conference and Exhibit *New Orleans, USA*
  Camargo, Jonathan; López, Omar; Ochoa, Nicolás.
  Presentation. 25-28 June 2012.

Undergraduate Projects Advised

Georgia Institute of Technology

- **"SpinVTOL - A Novel Aerial Vehicle"**
  Zhang, Zhiyuan; Liu, Tianyi; Song, Mulang; Liu, Yanbaihu; Zhu, Ning; Bai, Yatong. 2020
- **"Offload Control System for Deployable Boom Assemblies"**
  Brumfiel, Timothy; Chan, Tara; Cullen, Ian; Shapochka, Mark; Sauder, Brett; Welch, Hogan. 2020

Universidad de los Andes

- **"Teleoperación de un brazo robótico asistida por procesamiento de imágenes"** (Robotic arm teleoperation assisted by image processing)
  Sanchez, Natalia. 2017

- **"Teleoperación de un brazo robótico asistida por procesamiento de imágenes"** (Robotic arm teleoperation assisted by image processing)
  Sanchez, Natalia. 2017

- **"Conception and production of an exploratory vehicle based on cooperative sub-units"**
  Guerrero, Andrea. 2017

- **"Dynamics of herring gull wings: an underactuated approach"**
  Luna, Paola. 2017

- **"Prótesis funcional de mano con control y retroalimentación de fuerza"** (Hand prosthesis with force control and feedback)
  Benitez, Mario. 2016

- **"Caracterización experimental de la producción energética de una lámina biestable de fibra de carbono, debido a la interacción de fuerzas aerodinámicas en un montaje en voladizo"** (Experimental characterization of a bistable laminate with aerodynamic interaction)
  Echeverry, Alejandro. 2016

- **"Desarrollo de un asistente de aprendizaje robótico personal"** (A personal robotic learning assistant)
  Penagos, Daniel. 2015

- **"Diseño y manufactura de un mecanismo que realice el efecto Dolly Zoom"** (Design and manufacturing of a Dolly Zoom device)
  Romero, Juan Camilo. 2015

- **"Diseño y construcción de un robot inspirado en el salto de una rana"** (Design and manufacturing of a leap frog robot)
  Silva, Juan Diego. 2015

- **"Vehículo aéreo no tripulado (UAV) para protección de cultivos de arroz mediante control químico"** (UAV for crop protection)
  Alvarado, Julian. 2015

- **"Diseño y construcción de una impresora 3D mediante foto-solidificación"** (Design and fabrication of a SLA 3D printer)
  Ramirez, Julian. 2015

- **"Manufactura de un robot neumático deformable con movimiento peristáltico usando una resina elastomérica"** (Manufacturing of a peristaltic robot with elastomer resin)
  Murillo, Sebastian. 2015

- **"Characterization of the Dynamic Behavior of a Bistable Laminate for use in Energy Harvesting"**
  Monsalve, Jorge. 2014

- **"Prótesis funcional de mano con control y retroalimentación de fuerza"**(Active Hand Prosthesis with force control and feedback)
  Sánchez, Juliana. 2014
  Cimandes best final degree project Award

- **"Diseño y simulación de un robot neumático deformable"**(Design and simulation of a pneumatic deformable robot)
  Castelblanco, Alejandra. 2014
  Cimandes best final degree project Award

- **"Caracterización aerodinámica de láminas biestables de fibra de carbono"**(Aerodynamic Characterization of Carbon Fiber Bistable Laminates)
  Parra, Andres. 2014

- **"Desarrollo de placas biestables en fibra de carbono con piezoeléctricos para recolección de energía de las vibraciones"**(Carbon Fiber Bistable Laminates with Piezoelectrics for Energy Harvesting)
  Alfonso, Camilo. 2014

- **"Fabricación de actuadores neumáticos deformables"** (Fabrication of Pneumatic deformable actuators)
  Porras, Daniel. 2014