Short CV
Leonardo J. Colombo

Personal Webpage: https://sites.google.com/view/leonardojcolombo/home

Complete CV open access available at:

YouTube Channel: https://www.youtube.com/channel/UCa_SGtkPDe-XroDoKM4bnjQ
Video presentation at YouTube Channel - YouTube Channel ID: UCa_SGtkPDe-XroDoKM4bnjQ

Part A. PERSONAL DATA

Complete name:	Leonardo Jesús Colombo		
Marital Status: Married, 2 children.	Address: Calle Rio Guadalquivir 6, Urbanización Cerro Alarcón, Valdemorillo, 28210, Madrid, España.		
Nationality :	Argentinean (Spanish residence)	Date of birth:	21/10/1986 (34 years old)

A.1. Current professional situation

Dpto./Center	Institute of Mathematical Sciences (CSIC-UAM-UCM-UC3M)	
Address	Calle Nicolás Cabrera 13-15, Cantoblanco, 28049, Madrid	
Phone	+34 683472104	e-mail: leo.colombo@icmat.es
Current Position	Junior Leader "La Caixa" Foundation, Postdoctoral Fellowship (since 01/06/2019) - tenured researcher at CSIC in Center of Automation and Robotics (CAR) -waiting to take office	
Keywords	Control Theory, Robotics, Applied Mathematics, Unmanned Aerial Vehicles, Machine Learning for Dynamics and Control.	

A.2. General indicators
Google Scholar cites : 398, h-index: 11

Project Manager (Principal investigator of research project): **4 projects** - La Caixa Junior Leader Postdoctoral Fellowship, Leonardo Grant for Researchers and Cultural Creators from BBVA Foundation, Juan de la Cierva Incorporación Fellowship from Ministry of Science and Innovation, Santander Iberoamérica Fellowship.

Number of research projects obtained as Co-IP: **1 project** (I-link, category A. Founded by CSIC).

Ph.D thesis supervised last 5 years: **3 Phd students** (2 in progress, to finish in 2023 and 2024).
Master thesis supervised last 5 years: **3 students** on Machine Learning, Optimal and Geometric Control.
Postdocs supervised on the last 5 years: **1 postdoc** (currently supervising until April 2023).
Technician hired under research projects: **1 tech** for hardware tests in drones coordination and cooperation.
Undergraduate students supervised last five years: **9 students.**

Parte B. RESUME (Short Presentation)
I am a **Junior Leader Postdoctoral Researcher** from **La Caixa Foundation** since June 2019, awarded with a research project (305,100.00 euros) to carry out research on control algorithms for cooperative tasks with drones at the Institute of Mathematical Sciences (ICMAT) per 3 years (06/2019-05/2022). I am also a beneficiary of one of the **Leonardo Grants** for Researchers and Cultural Creators from the **BBVA Foundation** (40,000 euros) for the development of online leaning-based controllers for cooperative and multi-agent systems. Previously, I was a **Juan de la Cierva Incorporación Researcher** (first candidate on the list of 2017 Winners in Mathematics) at CSIC and ICMAT (03/2018-05/2019) to carry research on hybrid systems (6,000 euros), **ACCESS** Linnaeus Center **Postdoctoral Fellow, KTH Royal Institute of Technology**, Stockholm, Sweden (06/2017-02/2018) and **Postdoctoral Assistant Professor at the University of Michigan** in Ann Arbor, USA (09 / 2014-05 / 2017). **Visiting Assistant Professor** (competitive position) in the Department of Systems and Control of the **Indian Institute of Technology in Bombay**, India (2018-2020). Vicent Caselles Award from the Royal Spanish Mathematical Society and the BBVA Foundation in 2016. I am also CO-IP of the **I-Link A Project supported by CSIC** on multi-agent control systems and aerial robots. My work focuses on the development of control laws for mechanical systems for the

coordination, tracking and learning of desired collective behaviors, and its applications in the robotics field. For this I use and develop techniques in control theory based on dynamical systems, numerical analysis, Bayesian statistics for Machine Learning, robotics and graph theory among other areas of applied mathematics. My work is supported with real experimentation of the control algorithms we develop with my research group.

This short CV summarizes some of my research activities in the last 5 years. A complete CV can be found at:

Parte C. RELEVANT ACHIEVEMENTS

C.1. Publications (last 5 years)
More than 40 Publications in high impact international journals and Proceedings of international conferences in Automation, Robotics and Applied Mathematics in the last 5 years - See personal webpage.
*C.1.1 Some Q1 Journals articles (JCR) **last 2 years** (2020-2021)*
1. N. Raj, L. Colombo, A. Simha. Structure-Preserving Reduced Attitude Control of Gyroscopes. **Automatica**. Vol 125, 109471, 2021. [Q1 Automation and Control Systems, JCR 2020, position 10/63].
2. L. Colombo and D. Dimarogonas. *Symmetry reduction for optimal control of multi-agent systems.* **IEEE Transactions on Automatic Control.** Vol 6(5), 2021. [Q1 Automation and Control Systems, JCR 2020, position 11/63].
3. E. Aranda Escolastico, L. Colombo and M. Guinaldo. *Periodic event-triggered targeted shape control of Lagrangian systems with discrete-time delay.* **ISA Transactions.** Vol 117, 139-149 2021. [Q1 Automation and Control Systems, JCR 2020, position 13/63].
4. J. Giribet, L. Colombo, P. Moreno, I. Mas, D. Dimarogonas. Dual Quaternion Cluster Space Formation Control. **IEEE Robotics and Automation Letters**. Vol 6(4) 6789-6796, 2021. [Q1 Robotics, JCR 2020, position 8/28].
5. J. Goodman and L. Colombo. *Variational collision avoidance on Riemannian Manifolds*. **SIAM Journal on Control and Optimization**. In press, 2021. [Q1 Applied Mathemathics, JCR 2020, position 55/265].
6. L. Colombo, D. Martin de Diego, A. Nayak and R. Sato de Almagro. *Geometric optimal trajectory tracking of nonholonomic mechanical systems*. **SIAM Journal on Control and Optimization**. 58(3), 1652–1675, 2020. [Q1 Applied Mathemathics, JCR 2020, position 55/265].
7. L. Colombo and E. Eyrea Irazu. *Symmetries and periodic orbits in simple hybrid Routhian systems*. **Nonlinear Analysis: Hybrid Systems.** Vol 36, 100857, 2020. [Q1 Automatic Control and Computer Sciences, JCR 2020 puesto 8/63, Q1 Matemática Aplicada, JCR 2020 position 2/254].
8. J. Goodman and L. Colombo. *On the existence and uniqueness of Poincaré maps for systems with impulse effects.* **IEEE Transactions on Automatic Control.** Vol 65 (4), 1815-1821, 2020. [Q1 Automation and Control Systems, JCR 2020, position 11/63].

C.2. Participation in International and National Sponsored Research Projects (last 5 years)
C2.1: Sponsored *Projects as Main Researcher*
1.``Safety Guarantees with data-driven controls for cooperative systems''. 2020 Leonardo Grant for Researchers and Cultural Creators, BBVA Foundation. (Nov. 2020-May 2022). **Amount: 39.987,00 Euros**.
2.''Decentralized strategies for cooperative robotic swarms". **La Caixa Foundation Junior Leader research project** (June 2019-May 2022). **Amount 305.100,00 Euros**.
3.``Planning with interpolant trajectories, and localization of agents using distance sensors in the design of control algorithms for the formation of multiple rotor-crafts (Co4Drones)". **Santander Iberoamérica Grant 2019** (March 2019-May 2019). **Amount 5.000 Euros**.
4. Budget Associated with **Juan de la Cierva Incorporación Research Project**, Ministry of Science and Innovation, Spain (March 2018-May 2019). **Amount: 6.000 Euros.**
C.2.2: Participation in International Projects
5. The interplay between geometry, mechanics and control in multi-agent systems. **I-Link A Project.** Spanish Research Team: David Martin de Diego and Leonardo Colombo. **Spanish National Research Council (CSIC),** 2019-2021, (**24.000 Euros**).
6. EU H2020 ICT #731869. Co4Robots. PI: Dimos Dimarogonas, KTH, Sweden. (partial time, working in a specific research task), 2017-2018 (**3.820.956,25 Euros**).
7. EU H2020 ICT #644128. AEROWORK. PI: Dimos Dimarogonas, KTH, Sweden. (partial time, working in a specific research task), 2017, (**3.671.935,00 Euros**).
8. NSF-INSPIRE Track 1: The Mathematics of Balance in Mechanical Systems with Impacts, Unilateral Constraints, Underactuation and Hyper-sensing: Application to Agile bipedal Locomotion. PI's: Jessy Grizzle and Anthony Bloch. University of Michigan, Ann Arbor, US, 2015-2017 (**800.000,00 American Dollars**).
C.2.3: Participation in National (Spanish) Projects
9. 2020-2023 Geometric structures in dynamical systems, mechanics and hydrodynamics. **PID2019-106715GB-C21**. Principal researchers: David Martín de Diego (ICMAT-CSIC), Daniel Peralta Salas (ICMAT-CSIC), MICINN Spain, (**76.287,00 Euros**).
10. 2017-2020 Geometric and numerical analysis of dynamical systems and applications to mathematical physics: **MTM2016-76072-P**. Principal researchers: David Martín de Diego (ICMAT-CSIC), Daniel Peralta Salas (ICMAT-CSIC), MICINN Spain, (**53.900,00 Euros**).

C.6. Experience in organizing R&D activities

Member of scientific committee for International Young Researchers Workshop on Geometry, Mechanics and Control. May 2016- Feb2020. **Miember organizing committee (I)** 13th, **International Young Researchers Workshop on Geometry, Mechanics and Control**, Coimbra Portugal, Dec 2018.
(II) Special Session Geometric Structures applied to classical mechanics, control theory and engineering. **Bienal Congress of the Spanish Royal Mathematical Society**. Santander, Feb 2019. **(III)** XXVIII **International Fall Workshop on Geometry and Physics**, Madrid, Spain, Sep 2019.
(IV) Special session "The interplay of mathematical engineering and control of networked systems", **ICIAM Conference**, Valencia, July 2019. **(V) Temathic trimester** ``Current trends in geometric methods in natural sciences", ICMAT, Sept-Dec, 2019. **(VI)** Special session in the **V Congreso de Jóvenes Investigadores RSME**. Castellón, Jan 2020. **(VII)** 15th International Summer School on Geometry, Mechanics and Control. 2021, Madrid. **(VIII)** Local Organizer. EECI 2021, International Graduate School on Control. Course M09, Madrid. http://www.eeci-igsc.eu/igsc-program-2021/

C.7 Awards and competitive achievements.

1. Vicent Caselles Award 2016 (Vicent Caselles Award - 2016) Spanish Royal Mathematical Society **RSME** and **BBVA Foundation** (best 6 Spanish young researchers in mathematics under 30 years old).
2. Outstanding Postdoctoral Assistant Professor Teaching Award in Mathematics, University of Michigan, 2016.
3. ACCESS Linnaeus Center Scholarship, KTH Royal Institute of Technology, Stockholm, Sweden. Selected as **one of 2 winning candidates** from around 60 applicants in 2017.
4. Juan de la Cierva Incorporación. **Ranked 1st** of 4 winning candidates in mathematics (2017).
5. Santander Iberoamérica 2018 Fellowship: Fellow from Santander Bank to carry out research on geometric control of multi-agent systems with applications to cooperative drones in Coimbra, Portugal. Amount 5.000 Euros.

C.8 Outreach and Communication of Research

Collaboration in the dissemination programs of ICMAT 4th ESO School and Business; Graffiti and Maths. Articles published in Outreach Magazines (Matematicalia). Collaboration in blogs of science: La Caixa, Mathematics and its frontiers, Section Coffee and Theorems from El Pais Newspaper and ICMAT, etc. Participation and finalist in "We are Scientists - Get us out of here" - FECYT. See my web page section Media and Outreach for more details.

C.9 *Editorial and Reviewer activities*

Member of Program Committee SIAM Conference on Control and its Applications 2021**, Associated Editor Journal Geometric Mechanics** since March 2020**, Editor in the special issue for J. Geometric Mechanics** dedicated to the 65 years of Prof. A. Bloch, 2021-2022. Reviewer for **AMS Mathematical Reviewers** (from 2013). **Reviewer of several research papers in more than 25 International high ranked Journals** including: IEEE Transactions on Automatic Control, IEEE Transactions on Control Systems Technology, Automatica, SIAM Journal of Control and Optimization, Journal of Nonlinear Science, Nonlinearity, IEEE Transactions Control Network Systems, IEEE Control Systems Letters, Journal Optimization Theory and Appl., Journal Geometric Mechanics,… **Science mentor** of the section Mathematics for Frontiers for Young Minds http://home.frontiersin.org/, **Reviewer of several International Conference Papers** including: IEEE Conference on Decision and Control, American Control Conference, European Control Conferences, International Conference on Robotics and Automation, etc. **Editor for the Book** *Mathematical Texts, University of Coimbra,* Volume 48, 2019. 13th Young Researchers Workshop on Geometry, Mechanics and Control. Editors: Maria Barbero Liñan, Margarida Camarinha, Raquel Caseiro, Leonardo Colombo, Joana Nunes da Costa.

C.10 Presentations as speaker in some International Conferences (invited/contributed - last 2 years)

1.Dual Quaternion Cluster Space Formation Control. 2021 **IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2021)**. Prague, Czech Republic, 2021 (online).
2. Geometric integration for formation control of multi-agent systems. ***Conf. on the Numerical Solution of Differential and Differential-Algebraic Equations,*** University Halle-Wittenberg, Germany, 2021, (online).
3. Safe online learning-based control of multi-agent systems with Gaussian processes. **National Congress of the Portuguese Mathematical Society 2021**, Porto, Portugal, 2021 (online).
4. Mathematical methods for cooperative and multi-agent systems. Main speaker of **joint virtual seminar "Advance robotics, two convergent viewpoints" of the Royal Spanish Mathematical Society and the Spanish Committee for Automatica,** 2021.
5. A data-driven method based on quadratic programming for formation control of Euler-Lagrange systems. **59th Conference on Decision and Control** (CDC). Jeju Island, Republic of Korea, 2020 (online).
6. Forced variational integrators for distance based shape control with flocking behavior for multi-agent systems. Proceedings of the **IFAC World Congress**, Berlin, Germany, 2020 (online).
7. Distributed targeted distance-based formation control for mechanical systems. ***European Control Conference*****,** Saint Petersburg, Russia, 2020 (online).