Esteban RESTREPO

Ph.D. in automatic control

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Research topics: Control of multi-agents systems
Keywords: Automatic control, multi-agent systems, nonlinear systems, Lyapunov analysis, robotics, UAVs

Research experience

Current position

Feb. 2023–today **Post-doctoral researcher**,
IRISA, CNRS, INRIA Rennes – Bretagne Atlantique, France
- Title: "Postdoc in Shared Control for Multi-Robot Systems"
- under the supervision of Paolo Robuffo Giordano

Previous positions

Jan. 2022–Jan. 2023 **Post-doctoral researcher**,
Division of Decision and Control Systems, KTH Royal Institute of Technology, Sweden
- Title: "Postdoc position in hybrid control of multi-robot systems"
- under the supervision of Dimos Dimarogonas

2018–2021 **Ph.D. candidate in automatic control**,
DTIS ONERA, L2S, UMR 8506 CNRS, Université Paris-Saclay, France
- Title of the thesis: "Coordination Control of Autonomous Robotic Multi-agent Systems under Constraints." HAL Id : tel-03537341
- Best thesis award from GdR MACS and Club EEA
- Time for the preparation of the thesis: 3 years and 2 months (01 octobre 2018 - 30 novembre 2021)
- Supervisors: Antonio Loría (DR CNRS), Julien Marzat (HDR Research engineer), Ioannis Sarras (Research engineer)
- Jury: Dimos Dimarogonas (PR, KTH), Paolo Robuffo Giordano (DR CNRS), Magnus Egerstedt (PR, UCI), Sandra Hirche (PR, TUM)
- Links to the defense reports:

Education

2018–2021 **Ph.D. on Information and Communication Sciences and Technologies**,
Université Paris-Saclay, Saclay, France
- Title of the thesis: "Coordination Control of Autonomous Robotic Multi-agent Systems under Constraints." HAL Id : tel-03537341

2017–2018 **M.Sc. on Advanced Systems and Robotics**,
Arts et Métiers ParisTech (ENSAM), Sorbonne Université, France
- Autonomous robots: modeling, control and perception of robotic systems
- Research internship at ONERA: "Robust guidance of a miniature drone in an environment with dynamic obstacles."

2015–2017 **Engineering degree**,
Arts et Métiers ParisTech (ENSAM), France
- Major: Mechatronics
- Internship at CorWave S.A.: Cardiac pump test-bench automation

2012–2015 **Engineering degree**,
Universidad EIA, Colombie
- Major: Mechatronics
- Double-degree program at Arts et Métiers ParisTech

Continuous learning

2020 **Modeling and Control of Nonlinear and Distributed Parameter Systems: the Port Hamiltonian Approach**, *EECI International Graduate School on Control, France*

2019 **Distributed Coordination of Multi-agent Systems**, *EECI International Graduate School on Control, Germany*

2019 **Passivity Based Control**, *Université Paris-Saclay*, France

2018 **Stability of Dynamical Systems**, *Université Paris-Saclay*, France

Student supervision

2022 (on-going) **Ph.D. on automatic control: "Simultaneous Network Identification and Control for Heterogeneous Multi-Agent Systems"**,
co-supervised with D. Dimarogonas et P. Tajvar, KTH Royal Institute of Technology (25%)

2021 (6 months) **Master's research internship: "Formation control of autonomous vehicles"**,
co-supervised with A. Loría , L2S CentraleSupélec (50%)

Invited researcher

2021 (2 months) **NTNU : Norwegian University of Science and Technology**, *Trondheim, Norway*,
Research work in collaboration with Dr. Kristin Y. Pettersen.

2020 (1 month) **University of Guadalajara**, *Guadalajara, Mexico*,
Research work in collaboration with Dr. Emmanuel Nuño

Talks

2022 **Journées du Club EEA**, *online*

2022 **Journées de la SAGIP**, *Bidart, France*

2021 **Journée du GT SYNOBS - GdR MACS**, *Paris, France*

2021 **Journée du GT UAV - GdR Robotique**, *Paris, France*

2019 **Journée du GT SYNOBS - GdR MACS**, *Paris, France*

Awards and prizes

2022 **Best thesis award**, *GdR MACS and Club EEA*

2021 **Best thesis award**, *ONERA*

2020 **Best presentation award**, *Journée des doctorants L2S Centralesupélec*

2018 **Silver medal for academic excellence** (master's degree), *Ecole Nationale Supérieure d'Arts et Métiers*

2017 **Silver medal for academic excellence** (engineering degree), *Ecole Nationale Supérieure d'Arts et Métiers*

2015 **"Young engineers" scholarship**, *Colombian government and french ministry higher education, research and innovation*

Other activities

2022 **Lecturer for the FEL3330 Ph.D. Course on Networked and Multi-Agent Control Systems**, *KTH Royal Institute of Technology*,
Course on consensus algorithms for multi-agent systems

Reviewer for international scientific journals and conferences

- **Journals :** Automatica, IEEE Transaction on Automatic Control, IEEE Control Systems Letters, IEEE Transactions on Control of Network Systems, IEEE Robotics and Automation Letters, Systems & Control Letters, Journal of Guidance Control and Dynamics
- **Conférences :** IEEE Conference on Decision and Control, European Control Conference, IEEE International Conference on Robotics and Automation

Languages and skills

- English (fluent), French (bilingual), Spanish (mother tongue).
- [Programming] : Matlab – Simulink – C++ – Python – LabVIEW
- [Robotics] : ROS – Gazebo

Scientific output

The scientific output hereafter are listed from the most recent to the oldest by type as follows:

- [J] for the published articles in international scientific journals
- [C] for the articles presented at scientific international conferences
- [Pr] for the pre-published articles or in preparation to be submitted to scientific international journals and conferences

Links to all the published articles are provided in the form a DOI or HAL reference number.

Articles in international scientific journals

[J1] **Restrepo, E.**, Dimarogonas, D. V., "On Asymptotic Stability of Leader–Follower Multiagent Systems Under Transient Constraints". In: *IEEE Control Systems Letters* 6 (2022), pp. 3164–3169. DOI: 10.1109/LCSYS.2022.3182846.

[J2] Nuño, E., Loría, A., Panteley, E., **Restrepo, E.,** "Rendezvous of Nonholonomic Robots via Output-Feedback Control under Time-varying Delays". In: *IEEE Transactions on Control Systems Technology* (2022), pp. 1–10. DOI: 10.1109/TCST.2022.3144031, HAL: hal-03275333.

[J3] Romero, J. G., Nuño, E., **Restrepo, E.**, Cisneros, R., Morales, M., "A Smooth Time-Varying PID Controller for Nonholonomic Mobile Robots Subject to Matched Disturbances". In: *Journal of Intelligent & Robotic Systems* 105.13 (2022). DOI: 10.1007/s10846-022-01622-3.

[J4] **Restrepo, E.**, Loría, A., Sarras, I., Marzat, J., "Robust Consensus of High-Order Systems under Output Constraints: Application to Rendezvous of Underactuated UAVs". In: *IEEE Transactions on Automatic Control* (2021). DOI: 10.1109/TAC.2022.3144107, HAL: hal-03275331.

[J5] **Restrepo, E.**, Loría, A., Sarras, I., Marzat, J., "Edge-based strict Lyapunov functions for consensus with connectivity preservation over directed graphs". In: *Automatica* 132 (2021), p. 109812. DOI: 10.1016/j.automatica.2021.109812, HAL: hal-03306580.

[J6] **Restrepo, E.**, Loría, A., Sarras, I., Marzat, J., "Stability and robustness of edge-agreement-based consensus protocols for undirected proximity graphs". In: *International Journal of Control* (2020), pp. 1–9. DOI: 10.1080/00207179.2020.1800101, HAL: hal-02932046.

[J7] **Restrepo, E.**, Loría, A., Sarras, I., Marzat, J., "Leader-follower Consensus of Unicycles with Communication Range Constraints via Smooth Time-invariant Feedback". In: *IEEE Control Systems Letters* 5.2 (2020), pp. 737–742. DOI: 10.1109/LCSYS.2020.3005181, HAL: hal-02901383.

Articles presented at international scientific conferences

[C1] **Restrepo, E.**, Loría, A., Sarras, I., Marzat, J., "Consensus of Open Multi-agent Systems over Dynamic Undirected Graphs with Preserved Connectivity and Collision Avoidance". In: *61st IEEE Conference on Decision and Control (CDC)* (2022), pp. 4609–4614. DOI: 10.1109/CDC51059.2022.9993102.

[C2] **Restrepo, E.**, Matouš, J., Pettersen, K. Y., "Tracking-in-Formation of Multiple Autonomous Marine Vehicles under Proximity and Collision-Avoidance Constraints". In: *2022 European Control Conference (ECC)* (2022), pp. 930–937. DOI: 10.23919/ECC55457.2022.9838207, HAL: hal-03513288.

[C3] **Restrepo, E.**, Loría, A., Sarras, I., Marzat, J., "Robust Rendezvous Control of UAVs with Collision Avoidance and Connectivity Maintenance". In: *2022 American Control Conference (ACC)* (2022), pp. 4733–4738. DOI: 10.23919/ACC53348.2022.9867434.

[C4] **Restrepo, E.**, Loría, A., Sarras, I., Marzat, J., "Distributed full-consensus control of multi-robot systems with range and field-of-view constraints". In: *2021 IEEE International Conference on Robotics and Automation (ICRA)*. 2021, pp. 1890–1895. DOI: 10.1109/ICRA48506.2021.9561551, HAL: hal-03334305.

[C5] **Restrepo, E.**, Loría, A., Sarras, I., Marzat, J., "Robust Consensus and Connectivity-maintenance under Edge-agreement-based Protocols for Directed Spanning Tree Graphs". In: *IFAC-PapersOnLine* 53.2 (2020), pp. 2988–2993. 21st IFAC World Congress. DOI: 10.1016/j.ifacol.2020.12.978, HAL: hal-02917400.

[C6] **Restrepo, E.**, Sarras, I., Loría, A., Marzat, J., "Leader-follower consensus of unicycle-type vehicles via smooth time-invariant feedback". In: *In Proceedings of the European Control Conference* (2020), pp. 917–922. DOI: 10.23919/ECC51009.2020.9143718, HAL: hal-02874007.

[C7] **Restrepo, E.**, Sarras, I., Loría, A., Marzat, J., "3D UAV Navigation with Moving-Obstacle Avoidance Using Barrier Lyapunov Functions". In: *IFAC-PapersOnLine* 52.12 (2019), pp. 49–54. Presented at the 21st IFAC Symposium on Automatic Control in Aerospace.

Pre-published articles or in preparation

[Pr1] **Restrepo, E.**, Matouš, J., Pettersen, K. Y., "Tracking-in-Formation of Multiple Marine Vehicles Under Hard and Soft Constraints". In: (2023). In preparation.

[Pr2] **Restrepo, E.**, Wang, N., Dimarogonas, D. V., "Simultaneous Synchronization and Topology Identification of Complex Dynamical Networks". In: *62nd IEEE Conference on Decision and Control (CDC)* (2023). In preparation.

[Pr3] **Restrepo, E.**, Wang, N., Dimarogonas, D. V., "Simultaneous Topology Identification and Synchronization of Directed Dynamical Networks". In: (2023). In preparation.

[Pr4] Lazri, A., **Restrepo, E.**, Loría, A., "Robust leader-follower formation control of autonomous vehicles with unknown leader velocities". In: *2023 European Control Conference (ECC)* (2023). Submitted for presentation.

[Pr5] Romero, J. G., Nuño, E., **Restrepo, E.**, Sarras, I., "Global Consensus-based Formation Control of Nonholonomic Mobile Robots with Time-Varying Delays and without Velocity Measurements". In: *IEEE Transactions on Automatic Control* (2022). Accepted for publication as a Technical Note.

Thesis

[Thèse1] **Restrepo, E.** "Coordination control of autonomous robotic multi-agent systems under constraints". PhD thesis. Université Paris-Saclay, 2021. HAL Id : tel-03537341 .