

# Pol Mestres

PHD STUDENT · SYSTEMS AND CONTROL

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## Education

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### University of California, San Diego

*La Jolla, California, USA*

PHD MECHANICAL ENGINEERING

*09 2020 - present*

- Advisor: Dr. Jorge Cortés
- Research topics: safety-critical control, motion planning, safe reinforcement learning, optimization-based controllers

### University of California, San Diego

*La Jolla, California, USA*

MS MECHANICAL ENGINEERING

*09 2020 - 07 2021*

- GPA: 3.966.
- Specialization in Dynamical Systems and Control
- Coursework: Linear Systems, Parametric Identification, Cooperative Control of Multiagent Systems, Nonlinear Systems, Optimal Estimation, Convex Optimization, Nonlinear Control, Linear Control Design, Optimal Control, Hybrid Systems.

### Universitat Politècnica de Catalunya

*Barcelona, Spain*

BS MATHEMATICS, BS ENGINEERING PHYSICS

*09 2015 - 06 2020*

- Bachelor's Thesis at the University of California, San Diego, (10/10 with honors).

## Publications

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### JOURNAL PUBLICATIONS

- 9.- P. Mestres, C. Nieto-Granda, and J. Cortés. Safe and Dynamically-Feasible Motion Planning using Control Lyapunov and Barrier Functions, *IEEE Transactions on Robotics*, submitted.
- 8.- Y.Chen, P. Mestres, J. Cortés, and E. Dall'Anese. Equilibria and Their Stability Do Not Depend on the Control Barrier Function in Safe Optimization-Based Control, *Automatica*, submitted.
- 7.- P. Mestres and J. Cortés, Converse Theorems for Certificates of Safety and Stability. *IEEE Transactions on Automatic Control*, submitted.
- 6.- P. Mestres, C. Nieto-Granda and J. Cortés, Distributed Safe Navigation of Multi-Agent Systems using Control Barrier Function-Based Optimal Controllers. *IEEE Robotics and Automation Letters*, to appear and to be presented at ICRA 2025.
- 5.- P. Mestres, A. Allibhoy and J. Cortés. Regularity Properties of Optimization-Based Controllers. *European Journal of Control*, to appear as Keynote Invited Paper.
- 4.- P. Mestres, K. Long, N. Atanasov and J. Cortés. Feasibility Analysis and Regularity Characterization of Distributionally Robust Safe Stabilizing Controllers. *IEEE Control Systems Letters*, vol. 8 (2024), pp. 91-96.
- 3.- P. Mestres and J. Cortés. Feasibility and Regularity Analysis of Safe Stabilizing Controllers under Uncertainty. *Automatica*, vol. 167, pp. 111800 (2024).
- 2.- P. Mestres and J. Cortés. Optimization-Based Safe Stabilizing Feedback with Guaranteed Region of Attraction. *IEEE Control Systems Letters* (with joint submission to 61st IEEE Conference on Decision and Control), 7 (2023), 367-372.
- 1.- M. Vaquero, P. Mestres, J. Cortés. Resource-Aware Discretization of Accelerated Optimization Flows. *IEEE Transactions on Automatic Control*, 68 (4) (2023).

### CONFERENCE PUBLICATIONS

- 5.- P. Mestres, A. Marzabal and J. Cortés, Anytime Safe Reinforcement Learning, 7th Annual Learning for Dynamics and Control Conference, submitted.
- 4.- Y. Chen\*, P. Mestres\*, E. Dall'anese and J. Cortés, Characterization of the Dynamical Properties of Safety Filters for Linear Planar Systems, 63rd IEEE Conference on Decision and Control, to appear.

- 3.- P. Mestres, K. Long, M. Leok, N. Atanasov and J. Cortés, Stabilization of Nonlinear Systems through Control Barrier Functions, 63rd IEEE Conference on Decision and Control, to appear.
- 2.- P. Mestres, J. Cortés. 2023. Distributed and Anytime Algorithm for Network Optimization Problems with Separable Structure. Proceedings of the 62nd IEEE Conference on Decision and Control, Singapore, pp. 5457-5462.
- 1.- P. Mestres, J. Cortés. 2022. Safe Design for Controlling Epidemic Spreading under Heterogeneous Testing Capabilities. Proceedings of the American Control Conference, Atlanta, Georgia, 2022, pp. 697-702 .

## Professional Experience

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### **U.S. Army DEVCOM Army Research Laboratory**

*Adelphi, Maryland*

RESEARCH INTERN

*06 2024 - 09 2024*

- Design of dynamically feasible motion planning algorithms and implementation in simulation and hardware in robotic platforms such as Clearpath Jackal and Husky robots.

### **U.S. Army DEVCOM Army Research Laboratory**

*Adelphi, Maryland*

RESEARCH INTERN

*06 2023 - 09 2023*

- ROS implementation of safe navigation algorithms for multi-agent systems. The algorithm was tested in simulation and in real robotic platforms, such as Clearpath Jackal and Husky robots.

### **Barcelona Supercomputing Center - Computational Biology Group**

*Barcelona, Spain*

RESEARCH INTERN

*06 2019 - 08 2019*

- Data science for epigenetics. The aim of the project was to reconstruct a given cell differentiation tree by using epigenetic data such as hi-c chromatine contacts, histone marks data, etc.

### **BaseTIS**

*Barcelona, Spain*

DATA SCIENCE INTERN

*06 2018 - 08 2018*

- Machine learning techniques for image recognition.

### **Institut de Robòtica Industrial (IRI)**

*Barcelona, Spain*

RESEARCH INTERN

*06 2017 - 08 2017*

- Detection of variable symmetries in constraint satisfaction problems.

## Talks

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November 2024. Dynamical Properties of Control Barrier Function-Based Safety Filters. 44th Southern California Controls Workshop.

April 2024. Distributed Safe Navigation using Control Barrier Functions. Poster session. Jacobs School of Engineering Research Expo 2024.

December 2022. *Optimization-Based Safe Stabilizing Feedback with Guaranteed Region of Attraction*. Regular session at the 61st IEEE Conference on Decision and Control.

November 2022. *Optimization-Based Controllers for Safety-Critical Systems*. Robograds. UC San Diego.

June 2022. *Optimization-Based Safe Stabilizing Feedback with Guaranteed Region of Attraction*. Poster Session at the SoCal Hub Workshop on Secure Autonomy, University of California, Riverside, USA.

June 2022. *Safe Policy Design for Controlling Epidemic Spreading under Heterogeneous Testing Capabilities* Rapid Interactive Session at the 2022 American Control Conference, Atlanta, Georgia, USA.

## Awards, Fellowships, & Grants

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- 2020-2021 **MAE First Year Fellowship**, Department of Mechanical and Aerospace Engineering, UCSD
- 2015-2020 **CFIS Half Tuition and Housing Fellowship**, CFIS-UPC
  - 2018 **Finalist - HackUPC**, Universitat Politècnica de Catalunya
  - 2018 **Winner - Datathon CFIS**, Centre de Formació Interdisciplinària Superior (CFIS)
  - 2015 **Excellence Distinction on the University Entrance Exam**, Generalitat de Catalunya
  - 2015 **Silver Medal in Spanish Physics Olympiad**, Real Federación Española de Física
  - 2015 **Silver Medal in Catalan Physics Olympiad**, Societat Catalana de Física

## Teaching Experience

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- Spring 2024 **MAE 281b (Nonlinear Control)**, Teaching Assistant
- Fall 2024 **MAE 286 (Hybrid Systems)**, Teaching Assistant

## Mentoring

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- Summer 2024 **Jiayi Yan**, Undergraduate, The Chinese University of Hong Kong, Shenzhen. International Student Research Program
- Fall 2024 **Arnau Marzabal**, Undergraduate, Universitat Politècnica de Catalunya. Bachelor's Thesis Mobility Program

## Outreach & Professional Development

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### PEER REVIEW

- IEEE Transactions on Automatic Control
- IEEE Conference on Decision and Control
- International Conference on Robotics and Automation (ICRA)
- IEEE Robotics and Automation Letters
- American Control Conference
- European Control Conference
- IEEE Transactions on Control of Network Systems
- Automatica
- International Journal of Robust and Nonlinear Control
- IEEE Open Journal of Control Systems

### PROFESSIONAL MEMBERSHIPS

- IEEE Student Member
- SIAM Student Member

### SERVICE

- UCSD Robograds - Treasurer (School year 2023-2024)

## Skills

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**Programming:** Python, C++, MATLAB, R, AMPL, Mathematica.

**Software:** ROS, Linux, LaTeX, LabVIEW.

**Languages:** Catalan (native), Spanish (native), English (fluent), French (basic).