

Pol Mestres

PHD STUDENT · SYSTEMS AND CONTROL

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Education

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

JOURNAL PUBLICATIONS

- 10.- P. Mestres, Y. Chen, E. Dall'anese, and J. Cortés. Control Barrier Function-Based Safety Filters: Characterization of Undesired Equilibria, Unbounded Trajectories, and Limit Cycles, *Journal of Nonlinear Science*, submitted.
- 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

U.S. Army DEVCOM Army Research Laboratory

RESEARCH INTERN

Adelphi, Maryland

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

RESEARCH INTERN

Adelphi, Maryland

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

RESEARCH INTERN

Barcelona, Spain

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 chromatin contacts, histone marks data, etc.

BaseTIS

DATA SCIENCE INTERN

Barcelona, Spain

06 2018 - 08 2018

- Machine learning techniques for image recognition.

Institut de Robòtica Industrial (IRI)

RESEARCH INTERN

Barcelona, Spain

06 2017 - 08 2017

- Detection of variable symmetries in constraint satisfaction problems.

Talks

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*. Robograde. 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

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

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

Mentoring

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

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
 Learning for Dynamics and Control Conference
 American Control Conference
 European Control Conference
 IEEE Transactions on Control of Network Systems
 Automatica
 IEEE Transactions on Control Systems Technology
 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

Programming: Python, C++, MATLAB, R, AMPL, Mathematica.
Software: ROS, Linux, LaTeX, LabVIEW.
Languages: Catalan (native), Spanish (native), English (fluent), French (basic).