

Pol Mestres

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Academic Positions

California Institute of Technology (Caltech)

Pasadena, California, USA

POSTDOCTORAL SCHOLAR

08 2025 - present

- Advisor: Dr. Aaron Ames

Education

University of California, San Diego

La Jolla, California, USA

PHD MECHANICAL ENGINEERING

09 2020 - 07 2025

- 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).

Publications¹

JOURNAL PUBLICATIONS

- 18.- S. S. Mousavi, P. Mestres, and A. D. Ames. Functional Observers for Output-Feedback Safety with High-Order Control Barrier Functions, IEEE Control Systems Letters, submitted.
- 17.- P. Mestres, S. S. Mousavi, P. Ong, and A. D. Ames. Safe Stabilizing Linear Feedback: Necessary and Sufficient Conditions, Optimality, and Margins, IEEE Control Systems Letters, submitted.
- 16.- K. Long, Y. Zhao, P. Mestres, L. Lindemann, N. Atanasov, J. Cortés. A Unified Perspective on Conformal Prediction and Wasserstein Distributionally Robust Optimization for Uncertainty Quantification, Annual Reviews in Control, submitted.
- 15.- K. Echigo, D. E. J. van Wijk, P. Mestres, E. Daş, J. W. Burdick, and A. D. Ames. Probabilistic Control Barrier Functions for Systems with State Estimation Uncertainty using Sub-Gaussian Concentration, IEEE Control Systems Letters, to appear.
- 14.- P. Mestres, S. S. Mousavi and A. D. Ames. Dynamical Properties of Safety Filters for Linear Systems and Affine Control Barrier Functions, IEEE Control Systems Letters, 10 (2026), 979-984.
- 13.- G. Delimpaltadakis*, P. Mestres*, J. Cortés, W. M. P. H. Heemels. Safe Feedback Optimization through Control Barrier Functions, IEEE Transactions on Automatic Control, provisionally accepted.
- 12.- P. Mestres, J. Cortés, and E. D. Sontag. Universal formulas for safe control and their neural network approximations, Systems and Control Letters, 215 (2026), 106480.
- 11.- P. Mestres, A. Marzabal, and J. Cortés. Off-Policy Reinforcement Learning with Anytime Safety Guarantees via Robust Safe Gradient Flow, IEEE Transactions on Automatic Control, provisionally accepted.

^{1*} denotes equal contribution

- 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*, 36 (2026), 41.
- 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*, 41 (2025), 6440-6459.
- 8.- Y.Chen, P. Mestres, J. Cortés, and E. Dall'Anese. Independence of closed-loop equilibria and stability from the choice of control barrier function for a given safe set, *Automatica*, 191 (2026), 113105.
- 7.- P. Mestres and J. Cortés, Converse Theorems for Certificates of Safety and Stability. *IEEE Transactions on Automatic Control*, 70 (12) (2025), 8016-8028.
- 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*, 9 (7) (2024), 6760-6767.
- 5.- P. Mestres, A. Allibhoy and J. Cortés. Regularity Properties of Optimization-Based Controllers. *European Journal of Control* 81 (2025), 101098, 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*, 167, (2024), 11180.
- 2.- P. Mestres and J. Cortés. Optimization-Based Safe Stabilizing Feedback with Guaranteed Region of Attraction. *IEEE Control Systems Letters*, 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

- 12.- M. Cohen, P. Ong, and P. Mestres, Safety Filtering with an Infinite Number of Constraints, 65th IEEE Conference on Decision and Control, to appear.
- 11.- S. S. Mousavi, P. Mestres, and A. D. Ames, Stability Analysis in Multi-Constraint Safety Filters for Linear Systems, 65th IEEE Conference on Decision and Control, to appear.
- 10.- Y. Chen, P. Mestres, E. Dall'Anese, and J. Cortés, Safe Policy Optimization via Control Barrier Function-based Safety Filters, 65th IEEE Conference on Decision and Control, to appear.
- 9.- P. Mestres*, S. S. Mousavi*, P. Ong, L. Yang, E. Das, J. W. Burdick, and A. D. Ames, Explicit Control Barrier Function-based Safety Filters and their Resource-Aware Computation, IFAC World Congress 2026, to appear.
- 8.- G. Bahati, R. M. Bena, M. Wilkinson, P. Mestres. R. K. Cosner, and A. D. Ames, Risk-Aware Safety Filters with Poisson Safety Functions and Laplace Guidance Fields, 2026 American Control Conference, New Orleans, Louisiana, USA, pp. 1942-1949.
- 7.- P. Mestres, B. Werner, R. K. Cosner, and A. D. Ames, Probabilistic Control Barrier Functions: Safety in Probability for Discrete-Time Stochastic Systems, 2026 American Control Conference, New Orleans, Louisiana, USA, pp. 110-117.
- 6.- G. Delimpaltadakis*, P. Mestres*, J. Cortés, and W. M. P. H. Heemels, Feedback Optimization with State Constraints through Control Barrier Functions, 64th IEEE Conference on Decision and Control, Rio de Janeiro, Brazil, 2025, pp. 1741-1746.
- 5.- P. Mestres, A. Marzabal, and J. Cortés, Anytime Safe Reinforcement Learning, Proceedings of the 7th Annual Learning for Dynamics and Control Conference, pp. 221-232 .
Selected for Oral Presentation. Nominated for Best Paper Award Finalist
- 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, Milan, Italy, 2024 pp. 8858-8863.
- 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, Milan, Italy, 2024, pp. 2397-2402.
- 2.- P. Mestres and 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, 2023, pp. 5457-5462.
- 1.- P. Mestres and J. Cortés. 2022. Safe Design for Controlling Epidemic Spreading under Heterogeneous Testing Capabilities. Proceedings of the American Control Conference, Atlanta, Georgia, USA, 2022, pp. 697-702.

Talks

- August 2026. Explicit Control Barrier Function-based Safety Filters and their Resource-Aware Computation, IFAC World Congress 2026. Busan, Republic of Korea.
- May 2026. Probabilistic Control Barrier Functions: Safety in Probability for Discrete-Time Stochastic Systems, 2026 American Control Conference. New Orleans, Louisiana, USA.
- April 2026. Safety Filters for Autonomous Systems: When They Misbehave and How to Fix Them. MCE Seminar. Caltech, Pasadena, California, USA.
- April 2026. Anytime Safe Reinforcement Learning and Neural Network-based Formulas for Control. ETH Zurich, remote.
- June 2025. Anytime Safe Reinforcement Learning. L4DC 2025. University of Michigan, Ann Arbor, USA.
- May 2025. Distributed Safe Navigation of Multi-Agent Systems using Control Barrier Function-Based Optimal Controllers. ICRA 2025. Atlanta, Georgia, USA.
- April 2024. Distributed Safe Navigation using Control Barrier Functions. Poster session at the MAE Department 60th Year Anniversary Celebration. UC San Diego.
- March 2024. Dynamical Limitations of CBF-based Safety Filters and a Hierarchical Control Solution. AMBER Lab. Caltech, Pasadena, California, USA.
- December 2024. Stabilization of Nonlinear Systems through Control Barrier Functions. 63rd IEEE Conference on Decision and Control. Milan, Italy.
- December 2024. Characterization of the Dynamical Properties of Safety Filters for Linear Planar Systems. 63rd IEEE Conference on Decision and Control. Milan, Italy.
- November 2024. Dynamical Properties of Control Barrier Function-Based Safety Filters. 44th Southern California Controls Workshop. University of Southern California.
- April 2024. Distributed Safe Navigation using Control Barrier Functions. Poster session. Jacobs School of Engineering Research Expo 2024. UC San Diego
- December 2022. *Optimization-Based Safe Stabilizing Feedback with Guaranteed Region of Attraction*. Regular session at the 61st IEEE Conference on Decision and Control. Cancún, Mexico.
- 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

- 2026 **Outstanding Mentor - SURF Program**, Caltech
- 2025 **Mechanical and Aerospace Engineering Outstanding Graduate Student Award**, UCSD
- 2020-2021 **MAE First Year Fellowship**, Department of Mechanical and Aerospace Engineering, UCSD
- 2015-2020 **CFIS 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 **Jingyi Zhong**, Undergraduate, University of Southampton. Visiting student.
Summer 2024 **Jiayi Yan**, Undergraduate, The Chinese University of Hong Kong, Shenzhen. International Student Research Program
Fall 2024 - Spring 2025 **Arnau Marzabal**, Undergraduate, Universitat Politècnica de Catalunya. CFIS Bachelor's Thesis Mobility Program
Summer 2026 **Varun Gabbita**, Undergraduate, Caltech. Summer Undergraduate Research Fellowship
Summer 2026 **Hampus Serneke**, Undergraduate, Lund University. Summer Undergraduate Research Fellowship

Outreach & Professional Development

PEER REVIEW

IEEE Transactions on Automatic Control
IEEE Conference on Decision and Control
IEEE Control Systems Letters
International Conference on Robotics and Automation (ICRA)
International Conference on Intelligent Robots and Systems (IROS)
IEEE Robotics and Automation Letters
Learning for Dynamics and Control Conference
American Control Conference
European Control Conference
IFAC World Congress
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
International Conference on Automation Science and Engineering (CASE)
Nonlinear Analysis: Hybrid Systems
IEEE Transactions on Industrial Electronics
IEEE Transactions on Automation Science and Engineering
Machine Learning
Autonomous Robots
IEEE Control Systems Magazine
Neural Networks

CONFERENCE AND WORKSHOP ORGANIZATION

45th Southern California Control Workshop

SERVICE

Member of the Control Systems Society (CSS) Technical Committee on Networks
UCSD Robograds - Treasurer (School year 2023-2024)

PROFESSIONAL MEMBERSHIPS

IEEE Member

Professional Experience

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. Reconstruction of cell differentiation trees through epigenetic data such as hi-c chromatin 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.

Skills

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

Software: ROS, Linux, LaTeX, LabVIEW.

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