

Pedro Roque

Curriculum Vitae

Education

- 2019–2024 **Ph.D. in Decision and Control Systems**, KTH, Stockholm, Sweden.
- 2015–2017 **MSc. Systems, Control and Robotics**, DUAL DEGREE BETWEEN IST - INSTITUTO SUPERIOR TÉCNICO AND KTH - ROYAL INSTITUTE OF TECHNOLOGY, Lisbon, Portugal and Stockholm, Sweden.
Merit board (Top 20% of the class) at IST. ECTS GPA: B
- 2012–2015 **BSc. Electrical and Computers Engineering**, IST, Lisbon, Portugal.
Merit board (Top 20% of the class) during the entire BSc. Degree. ECTS GPA: A

Publications

- 2022 ACC22 Roberto C. Sundin, **Pedro Roque**, Dimos V. Dimarogonas, "DECENTRALIZED MODEL PREDICTIVE CONTROL FOR EQUILIBRIUM-BASED COLLABORATIVE UAV BAR TRANSPORTATION".
Outstanding Coordination Award at ICRA2022. In this paper we derive centralized and decentralized model predictive control schemes for aerial collaborative load transportation with tethers. We compared these approaches in simulation and in an experimental setting, discussing the trade-offs of each controller.
- 2022 ACC22 **Pedro Roque**, Wenceslao S. Cortez, L. Lindemann, Dimos V. Dimarogonas, "CORRIDOR MPC: TOWARDS OPTIMAL AND SAFE TRAJECTORY TRACKING".
This work deals creating a robust model predictive control scheme that leverages zeroing control barrier functions to ensure safety of the continuous-time system being controlled, while minimizing the impact in the computational cost.
- 2020 IROS20 **Pedro Roque**, Elisa Bin, Pedro Miraldo and Dimos V. Dimarogonas, "FAST MODEL PREDICTIVE IMAGE-BASED VISUAL SERVOING FOR QUADROTORS".
Using a classic image-based visual servoing controller, we navigate a quadrotor to a desired pose, while considering its under-actuated dynamics in a linear model predictive controller capable of running online onboard the vehicle.
- 2020 IFAC20-WC **Pedro Roque**, Shahab Heshmati-Alamdari, Alexandros Nikou, and Dimos V. Dimarogonas, "DECENTRALIZED FORMATION CONTROL FOR MULTIPLE QUADROTORS UNDER UNIDIRECTIONAL COMMUNICATION CONSTRAINTS".
Considering a team of multiple aerial vehicles, we derived a model predictive controller that considers the cooperation between the agents to achieve an efficient distributed control scheme.
- 2020 IROS20 Nicola Lissandrini, Christos Verginis, **Pedro Roque**, Dimos V. Dimarogonas, "DECENTRALIZED NONLINEAR MPC FOR ROBUST COOPERATIVE MANIPULATION BY HETEROGENEOUS AERIAL-GROUND ROBOTS".
A model predictive control collaborative load transportation scheme considering aerial and ground robots, in a leader-follower scheme.
- 2018 IAC2018 Rodrigo Ventura, Monica Ekal, **Pedro Roque**, "TOWARDS AN AUTONOMOUS FREE-FLYING ROBOT FLEET FOR INTRA-VEHICULAR TRANSPORTATION OF LOADS IN UNMANNED SPACE STATIONS".
This article explores load inertial parameters estimation by comparing a predicted and accomplished set of trajectories with an un-modeled load attached.

- 2017 ICRA18 Pedro Pereira, **Pedro Roque**, Dimos V. Dimarogonas, “ASYMMETRIC COLLABORATIVE BAR STABILIZATION TETHERED TO TWO HETEROGENEOUS AERIAL VEHICLES”. We consider the case of aerial transportation with cables, using two different vehicles and tether lengths. We derived stabilizing PID controllers, and demonstrated the proposed scheme on two aerial vehicles.
- 2016 IJCAI-WS **Pedro Roque**, Rodrigo Ventura, “A SPACE COBOT FOR PERSONAL ASSISTANCE IN SPACE STATIONS”. This article extends the previous work on the Space CoBot project, focusing on two case studies: debris scavenging and astronaut assistive stabilization.
- 2016 IROS16 **Pedro Roque**, Rodrigo Ventura, “SPACE COBOT: A COLLABORATIVE AERIAL ROBOT FOR INDOOR MICROGRAVITY ENVIRONMENTS”. Development of a collaborative aerial robot for indoor microgravity environments, such as a space station, in which the robot shall provide aid for astronauts while doing other autonomous tasks. Project webpage: <https://space-cobot.isr.tecnico.ulisboa.pt>

Research Interests

- Space robotics Multi-agent systems, load transportation, human-robot interface
- Control theory Model predictive control (MPC) based approaches for low-level optimal control
- Computer vision Pose estimation, visual-servoing

Experience

- 2022 Ongoing **Laboratory Responsible**, DISCOVER SPACE ROBOTICS LABORATORY, KTH - ROYAL INSTITUTE OF TECHNOLOGY , Stockholm, Sweden.
Responsible for the creating and maintenance of the first Space Robotics Laboratory at KTH, in collaboration with the KTH Space Center, led by astronaut and Prof. Christer Fuglesang.
- 2016 **Research Engineer**, SMART MOBILITY LAB (SML), KTH - ROYAL INSTITUTE OF TECHNOLOGY , Stockholm, Sweden.
Research Engineer for Aeroworks (www.aeroworks2020.eu), Co4Robots (www.co4robots.eu) and SSF COIN (www.coinssf.se). Responsible for the integration of several systems at the Smart Mobility Lab.
- 2017 3 Months **Research Internship**, SPACE SYSTEM LAB (SSL), MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT), Cambridge, MA, USA.
Internship on the ReSWARM project, implemented a nonlinear model predictive formation controller on the MIT SPHERES. The first International Space Station test session consisted on validating the implementation of the algorithms, while the second consisted on comparing it with a common Proportional-Differential control approach.
- 2014–2017 **Avionic Systems Designer**, STINGRAY AVIONICS, Lisbon, Portugal.
Development of Avionic Systems, such as altitude sensor, speed sensor, attitude estimation, as well as an electronic flight instrument system (EFIS). Focus on low-level design (printed circuit boards development and production) and integration.
- 2015–2016 **Research Assistant**, ISR (INSTITUTE FOR SYSTEMS AND ROBOTICS), INSTITUTO SUPERIOR TÉCNICO, UNIVERSIDADE DE LISBOA, Lisbon, Portugal.
Grant in QuadMission project (ISR internal project), working with cooperation between ground and aerial robots. Started the Space Cobot project with Professor Rodrigo Ventura.

Projects

- 2022-
Ongoing **DISCOVER** - With the support and supervision of my PhD adviser Prof. Dimos Dimarogonas, and collaboration of Prof. Ivan Stenius, Prof. Jana Tumova and Prof. Christer Fuglesang, I wrote the DISCOVER. The proposal was funded by WASP with a total of 20 million SEK (2 million dollars), and is currently an ongoing project at KTH, with 3 new PhD students and creating the first Space Robotics Laboratory at KTH.
- 2016-2019 **Space CoBot** - The Space CoBot consists of a microgravity aerial robot targeting indoor usage and cooperative behaviour. This robot is based in an hexarotor design and supports full modularity and stackability for easy upgrade and storage. (Internal ISR Project)
- 2015-2016 **QuadMission** - The QuadMission consists of developing Quadcopters that are able to deal with real-life situations, such as Rescue Missions, Data Collection and Danger Scanning. (Internal ISR Project)
- 2013-2015
2 Years **ModDrone** - Started the development of a modular quadrotor with a group of students, based on open-source hardware and software. (Hackerschool Project)

Awards

- 2022 Winner of the Outstanding Coordination Award at ICRA2022.
- 2022 Scholarship attributed by KTH, to present my work on the American Control Conference 2022.
- 2012-2016 Merit Board for being among the top 20% performing students.
- 2012 4th Place in the portuguese National Science Show in the overall classification (out of 94 Projects) and first place in Physics Category.

Presentations

- 2022 Unniversity of Pennsylvania GRASP Lab
- 2020 Intelligent Robotic Systems group, Instituto Superior Técnico, Universidade de Lisboa
- 2020 Netcon Workshop
- 2014 Workshop - Introduction to Control Theory and Robotics.

Computer Skills

Software: Python, C, C++, Matlab, ROS, ROS2, PX4, Gazebo, V-REP, Linux, Microsoft Office.
Hardware: KiCad, Altium Designer, Eagle, Arduino, Raspberry Pi, PCB Design.

Interests

- Amateur guitar builder and player
- Electronics and robotics enthusiast
- Aviation and flights systems
- Practice football and swimming
- Bridging agriculture and technology
- Self-hosting and networks

Languages

Portuguese **Mothertongue**
English **Advanced**
Spanish **Intermediate**
Swedish **Basic**

Fluent at reading, writing and speaking.

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