

BÁRBARA BARROS CARLOS

PhD candidate

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Rome, Italy



PhD student in Automatica at Sapienza Università di Roma, with a bachelor degree in Mechatronics Engineering by IFCE, Brazil (2017). I've been working with underactuated systems, aerial robotics, dynamic modeling, trajectory generation and tracking, estimator design, and controller design with focus on Nonlinear Model Predictive Control (NMPC). I've dabbled with numerical optimization using CMA-ES incorporating it into modern control theory. I've been involved in embedded numerical optimization applied to a quadrotor and a pendubot at the Systems Control and Optimization Laboratory (syscop), Freiburg, Germany. I'm currently working on embedded NMPC for the quadcopters at LAAS-CNRS, Toulouse, France.

FORMATION

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|-----------------------------------|---|
| Present Nov 2017 | Sapienza Università di Roma, ROME, Italy PhD in Automatica, Bioingegneria e Ricerca Operativa <ul style="list-style-type: none">> Concentration in nonlinear model predictive control applied to quadrotors. |
| Jun 2017 | Instituto Federal do Ceará, FORTALEZA, Brazil B.Sc. in Mechatronics Engineering <ul style="list-style-type: none">> <i>Modeling, Control and Simulation of a Quadrotor for Attitude Stabilization.</i> |

PROFESSIONAL EXPERIENCE

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|------------------------------------|---|
| Present Oct 2019 | Laboratoire d'analyse et d'architecture des systèmes (LAAS-CNRS), VISITING PHD STUDENT, France <ul style="list-style-type: none">> Embedded NMPC applied to quadrotors.> NMPC design for quadrotor-slung payload system for the task of transportation on suspension. <div>NMPC Modeling Quadrotor C/C++ Python GenoM3 acados</div> |
| Oct 2019 May 2019 | IMTEK, University of Freiburg, VISITING PHD STUDENT, Germany <ul style="list-style-type: none">> Trajectory generation and tracking using NMPC for collision avoidance with dynamic obstacles for the Crazyflie nanoquadcopter.> Development of a tangential predictor for fast and real-time NMPC applied to a quadrotor.> Design of an optimal control problem for periodic trajectory generation to orbital stabilization of a pendubot.> Gain expertise in embedded numerical optimization methods. <div>NMPC NLP Direct Method Multiple Shooting Quadrotor Pendubot MATLAB Simulink CasADi acados C/C++ Python</div> |
| Present Nov 2017 | Sapienza Università di Roma, PHD STUDENT, Italy <ul style="list-style-type: none">> Dynamic modeling.> Underactuated systems.> Trajectory generation and tracking.> Numerical Optimization Methods> Nonlinear model predictive control applied to quadrotors. <div>NMPC MHE EKF Modeling Quadrotor Pendubot Underactuated Systems MATLAB C/C++ Python AprilTags</div> |

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|----------------------|---|
| Jun 2017 Mar 2015 | Instituto de Tecnologia da Informação e Comunicação (ITIC), RESEARCHER, Brazil <ul style="list-style-type: none"> > Quadrotor hardware technician. > Technical project writer. > Development of a quadrotor for remote and autonomous operation, used to perform inspections in indoor and outdoor environments. > Development of an autopilot using BeagleBone Black. <div>PID Quadrotor Python C Assembly BeagleBone Black</div> |
| Aug 2017 Aug 2014 | Laboratório de Inovação Tecnológica (LIT/IFCE), UNDERGRADUATE RESEARCH ASSISTANT, Brazil <ul style="list-style-type: none"> > Development of an autopilot using BeagleBone Black. > Mechanical construction of a quadrotor frame. > Quadrotor hardware technician. > Design and implementation of a PID controller for attitude stabilization of a quadrotor. > Development of an inspection solution to distribution low-voltage transformers using quadrotor and computer vision algorithms in order to recognize the environment and target objects. > Exploration of communications' API and control strategies for drones. > Adaptation of classical pattern and object recognition algorithms to parallel embedded platforms (such as the Jetson TK1 NVidia). <div>PID Quadrotor Python C Assembly Pattern Recognition</div> |
| Dec 2014 Dec 2013 | Instituto de Tecnologia da Informação e Comunicação (ITIC), EDUCATIONAL ROBOTICS TEACHER, Brazil <ul style="list-style-type: none"> > PIC 18FXX5X-based embedded systems development. > Teacher of logic, programming language, electricity and basic electronics. <div>Programming Electronics Electricity MIT Scratch Code::Blocks Hardware PIC18</div> |

PUBLICATIONS

- 2017 Carlos, Bárbara B.; de Oliveira, Antonio É. R. M.; de Alexandria, Auzuir R.; Sá, Rejane C.; Rodrigues, Antonio W. O. (2017) Modeling, Control and Simulation of a Quadrotor for Attitude Stabilization. In : Juan Carlos Figueroa-García; Eduyn Ramiro López-Santana; José Luis Villa-Ramírez; Roberto Ferro-Escobar. (Org.). Communications in Computer and Information Science. 4ed. Switzerland : Springer International Publishing, pp. 12-23, DOI : 10.1007/978-3-319-66963-2_2
- 2015 Carlos, Bárbara B.; Neto, Aluísio. C. Q. (2015) An Open-Source Hardware-Software Architecture for Educational Robotics. VI WORKSHOP DE ROBÓTICA EDUCACIONAL. 6ed. Uberlândia, Brazil : Sociedade Brasileira de Computação - SBC (WRE), pp. 58-63

SKILLS

| | |
|-------------------------------------|---|
| Building Systems | Catkin, CMake, Make |
| Development Tools | MATLAB, Vim, Terminal (Linux/macOS) |
| Numerical Optimization Tools | CasADi, ACADO, acados |
| Operating Systems | Linux, MacOS, ROS |
| Hardware | AVR Family (Atmega32), PIC18 Family, ARM Cortex-A8 Microprocessor |
| Misc | Rviz, Git, \LaTeX , GenoM3 |

PROGRAMMING LANGUAGES

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|--------|-----------|
| C/C++ | ● ● ● ● ● |
| MATLAB | ● ● ● ● ○ |
| Python | ● ● ● ○ ○ |

IDIOMS

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| Portuguese | ● ● ● ● ● |
| English | ● ● ● ● ● |
| Italian | ● ● ● ○ ○ |
| French | ● ○ ○ ○ ○ |

PROJECTS

NMPC FOR THE CRAZYFLIE 2.1

JUN 2019 - OCT 2019

 github.com/bcbarbara/crazyflie_nmpc

This package contains an efficient and modular implementation of a Nonlinear Model Predictive Control (NMPC) tailored for the Crazyflie's online trajectory generation and tracking problem. A Real-Time Iteration (RTI) scheme through a Sequential Quadratic Programming (SQP) online algorithm is used in order to solve the Nonlinear Program (NLP).

ROS C++ acados HPIPM BLASFEO

MENTORING

2018 | Sapienza Università di Roma, PROJECTS SUPERVISOR, Italy

- *A flying inverted pendulum*. 1st year student of Scuola superiore di studi Avanzati Sapienza (SsaS). Tutor : professor Alessandro De Luca.
- *The Dynamic Bearing Observability Matrix Nonlinear Observability and Estimation for Multi-Agent Systems*. Project supervision for the Control of Autonomous Multi-Agent Systems course.

LQR EKF Geometric Control Quadrotors Formation

CERTIFICATIONS

- 2018 *Model Predictive Control (MPC)*. Scuola IMT Alti Studi Lucca.
- 2017 *Robotics :Aerial Robotics*. Coursera.  [Credential ID AA6KBS8T8NAW](#) .
- 2012 *6.002x : Circuits and Electronics*. edX.  [Credential ID d6294aa7fab348ecbe395669399a687d](#).