Bárbara Barros Carlos
PhD candidate

in linkedin.com/in/bcbarb   **%** bcbarbara.github.io
☺ github.com/bcbarbara   **@** barros@diag.uniroma1.it
♥ Rome, Italy

PhD student in Automatica at Sapienza Università di Roma, with a bachelor degree in Mechatronics Engineering by IFCE, Brazil (2017). My research focuses on optimization-based motion planning and control of aerial systems. I've dabbled with numerical optimization using covariance matrix adaptation evolution strategy, incorporating it into modern control theory. I've been involved in embedded numerical optimization applied to quadrotors at the Systems Control and Optimization Laboratory (syscop), Freiburg, Germany. I've been working with embedded NMPC for quadcopters and optimization-based shared control at the Robotics and InteractionS (RIS) team at LAAS-CNRS, Toulouse, France.

🎓 FORMATION

Present Nov 2017	**Sapienza Università di Roma, ROME, Italy** PhD in Automatica, Bioingegneria e Ricerca Operativa › Concentration on numerical optimization methods applied to motion planning and control of quadrotors.
Jun 2017	**Instituto Federal do Ceará, FORTALEZA, Brazil** B.Sc. in Mechatronics Engineering › *Modeling, Control and Simulation of a Quadrotor for Attitude Stabilization.*

💼 PROFESSIONAL EXPERIENCE

Present Nov 2017	**Sapienza Università di Roma, PHD STUDENT, Italy** › Dynamic modeling. › Embedded numerical optimization methods for motion planning and control of quadrotors. Quadrotor · NMPC · MHE · EKF · Modeling · C/C++ · Python
Mar 2020 Oct 2019	**Laboratoire d'analyse et d'architecture des systèmes (LAAS-CNRS), VISITING PHD STUDENT, France** › Embedded NMPC applied to quadrotors. › Shared control between human and robot using numerical optimization › NMPC for quadrotor-slung payload system for the task of transportation on suspension. NMPC · Modeling · Quadrotor · C/C++ · Python · GenoM3 · acados
Oct 2019 May 2019	**IMTEK, University of Freiburg, VISITING PHD STUDENT, Germany** › Least conservative linearized constraint formulation for real-time motion generation applied to the Crazyflie nanoquadcopter. › Sensitivity-based real-time NMPC applied to a quadrotor. › Optimal control problem formulation for periodic trajectory generation to orbital stabilization of a pendubot. › Gain expertise in embedded numerical optimization methods. NMPC · NLP · Direct Methods · Multiple Shooting · Quadrotor · Pendubot · CasADi · acados · C/C++ · Python

Jun 2017 Mar 2015	Instituto de Tecnologia da Informação e Comunicação (ITIC), RESEARCHER, Brazil

Instituto de Tecnologia da Informação e Comunicação (ITIC), RESEARCHER, Brazil
Jun 2017 — Mar 2015
- › Quadrotor hardware technician.
- › Technical project writer.
- › Development of an autopilot using BeagleBone Black.

`PID` `Quadrotor` `Python` `C` `Assembly` `BeagleBone Black`

Laboratório de Inovação Tecnológica (LIT/IFCE), UNDERGRADUATE RESEARCH ASSISTANT, Brazil
Aug 2017 — Aug 2014
- › Development of an autopilot using BeagleBone Black.
- › Mechanical construction of a quadrotor frame.
- › 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).

`PID` `Quadrotor` `Python` `C` `Assembly` `Pattern Recognition`

Instituto de Tecnologia da Informação e Comunicação (ITIC), EDUCATIONAL ROBOTICS TEACHER, Brazil
Dec 2014 — Dec 2013
- › PIC 18FXX5X-based embedded systems development.
- › Teacher of logic, programming language, electricity and basic electronics.

`Programming` `Electronics` `Electricity` `MIT Scratch` `Code::Blocks` `Hardware` `PIC18`

📖 PUBLICATIONS

2020 Carlos, Bárbara B.; Sartor, Tommaso; Zanelli, Andrea; Diehl, Moritz; Oriolo, Giuseppe. *Least Conservative Linearized Constraint Formulation for Real-Time Motion Generation*. In : 21th IFAC World Congress.

2020 Turrisi, Giulio; Carlos, Bárbara B.; Cefalo, Massimo; Modugno, Valerio; Lanari, Leonardo; Oriolo, Giuseppe. *Enforcing Constraints over Learned Policies via Nonlinear MPC : Application to the Pendubot*. In : 21th IFAC World Congress.

2017 Carlos, Bárbara B.; de Oliveira, Antonio É. R. M.; de Alexandria, Auzuir R.; Sá, Rejane C.; Rodrigues, Antonio W. O. *Modeling, Control and Simulation of a Quadrotor for Attitude Stabilization*. In : Communications in Computer and Information Science. 4ed. Switzerland : Springer International Publishing, pp. 12-23.

☰ SKILLS

Building Systems	Catkin, CMake, Make
Development Tools	MATLAB, Simulink, Vim, Terminal (Linux/MacOS)
Numerical Optimization Tools	CasADi, ACADO, acados
NMPC Solvers	HPIPM, qpOASES, IPOPT
Operating Systems	Linux, MacOS, ROS
Hardware	AVR Family (Atmega32), PIC18 Family, ARM Cortex-A8 Microprocessor
Misc	Git, LaTeX, GenoM3

</> PROGRAMMING LANGUAGES

C/C++ ●●●●●
Python ●●●●○
MATLAB ●●●○○

🌐 IDIOMS

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

🖥 PROJECTS

NMPC FOR THE CRAZYFLIE 2.1   JUN 2019 - OCT 2019

🗘 github.com/bcbarbara/crazyflie_nmpc

This ROS stack contains the implementation of a position controller for the Crazyflie 2.1 based on NMPC with time-delay compensation and bounds enforcement on the actuators. Due to the limited computational resources onboard, an offboard high-level position controller is proposed using the recently released high-performance software package `acados` which exploits the real-time iteration (RTI) scheme with Gauss-Newton Hessian approximation. The quadratic problems (QPs) arising in the NMPC problem are solved with `HPIPM`, an interior-point solver, based on the linear algebra library `BLASFEO` which is hand optimized for most recent CPU architectures.

`ROS` `C++` `real-time NMPC` `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

2020   *Numerical Methods for Optimal Control*. IMT School for Advanced Studies Lucca
2018   *Model Predictive Control (MPC)*. IMT School for Advanced Studies Lucca
2017   *Robotics : Aerial Robotics*. Coursera ⬀ Credential ID AA6KBS8T8NAW
2012   *6.002x : Circuits and Electronics*. edX ⬀ Credential ID d6294aa7fab348ecbe395669399a687d