Bárbara Barros Carlos
PhD candidate

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 applied to aerial systems. 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 quadrotors at the Systems Control and Optimization Laboratory (syscop), Freiburg, Germany. I've been working with embedded NMPC for quad-copters 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 applied to motion planning 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.
- Underactuated systems.
- Trajectory generation and tracking.
- Numerical Optimization Methods
- Nonlinear model predictive control applied to quadrotors.

NMPC | MHE | EKF | Modeling | Quadrotor | Pendubot | Underactuated Systems | MATLAB | C/C++ | Python | AprilTags

Mar 2020 – Oct 2019 | **Laboratoire d'analyse et d'architecture des systèmes (LAAS-CNRS), Visiting PhD student, France**
- Embedded NMPC applied to quadrotors.
- NMPC design for quadrotor-slung payload system for the task of transportation on suspension.
- Shared control between human and drone using numerical optimization

NMPC | Modeling | Quadrotor | C/C++ | Python | GenoM3 | acados

Oct 2019 – May 2019 | **IMTEK, University of Freiburg, Visiting PhD student, Germany**
- 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.

NMPC | NLP | Direct Method | Multiple Shooting | Quadrotor | Pendubot | MATLAB | Simulink | CasADi | acados | C/C++ | Python

Jun 2017
Mar 2015

Instituto de Tecnologia da Informação e Comunicação (ITIC), Researcher, Brazil

- 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.

PID | Quadrotor | Python | C | Assembly | BeagleBone Black

Aug 2017
Aug 2014

Laboratório de Inovação Tecnológica (LIT/IFCE), Undergraduate Research Assistant, Brazil

- 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).

PID | Quadrotor | Python | C | Assembly | Pattern Recognition

Dec 2014
Dec 2013

Instituto de Tecnologia da Informação e Comunicação (ITIC), Educational Robotics Teacher, Brazil

- 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

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 Figeroa-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, Adobe Illustrator

Programming Languages

C/C++ ●●●●●
MATLAB ●●●○○
Python ●●●●○

Idioms

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.