# Francesco Russo

*Electronic Engineer & student in Control Engineering*

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🌐 *franc-r.github.io*
**in** *francesco-russo-MSc*

## Education

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|---|---|
| 2022–Present | **Master's Degree in Control Engineering**, *Università degli Studi La Sapienza*, Rome, Italy |
| 2018–2022 | **Bachelor's Degree in Electronics Engineering**, *Università degli Studi di Catania*, Italy, Final Mark: 105/110 |
| 2012–2017 | **Electronics High School Diploma**, *ITIS Ettore Majorana*, Ragusa, Italy |

## Academic Work-Projects (Details at franc-r.github.io)

**Dynamic Mode Decomposition, recognition of Spatial-Temporal patterns in large-scale Neural Recordings for imagination and movement tasks:**

> Neural recordings are essential for investigating the nervous system. Although they typically generate data that reside in a high-dimensional space, their underlying structure often lies in a low-dimensional one. Thus, the Dynamic Mode Decomposition technique is used to construct a reduced-order representation of these data, enabling the extraction of meaningful spatio-temporal patterns from large-scale neural recordings.

**DC-Motor Velocity Control Problem:**

> The goal of the project was to design a controller capable of driving the rotor of a DC motor at steady state and at a given angular velocity, while rejecting noise and attenuating disturbances through a closed-loop approach. The design involved minimizing the $H_\infty$ norm of the sensitivity, complementary sensitivity, and control sensitivity functions.

**DC-Motor Position Control Problem:**

> The goal of the project was to design an $H_\infty$ controller which is able to stop the rotor of DC-Motor at steady state at a given angular position and, at the same time, rejecting noise and attenuating disturbances, through a closed-loop approach.

**MIMO Analisys:**

> The goal of the project was to analyse the directional properties of MIMO systems, and assess how ill-conditioned the system is, by means Singular Value Decomposition. It also aimed to design an $H_\infty$ controller capable of robustly stabilising the MIMO system, taking into account both structured and unstructured uncertainties.

**Two Wheels Self-Balancing Robot:**

The aim of the project was to build a wheeled robot, designed with Autodesk Inventor and manufactured using a 3D printer, capable of autonomously maintaining balance. This was achieved by designing a controller implemented on an Arduino Nano, able to asymptotically stabilize the system's equilibrium point.

## Academic Work-Thesis (Details at franc-r.github.io)

*Bachelor's Degree*

**Motion Control of Robots: An Approach Based on Light Source Tracking**

Bachelor's degree thesis focused on the design and development of a 4-DOF bipedal robot, including the design and implementation of a control system, deployed on Arduino, to track a light source through bipedal locomotion.

*Master's Degree*

**Safety Management and Trust beetween Humans and Robots in BCI system:**

Master's degree thesis focuses on the design and control of an underactuated quadrotor controlled through brain–computer interface signals, where a safety-critical controller was implemented to ensure that the system operates within a predefined safe set. A novel trust-based approach was proposed to dynamically evaluate the reliability of the BCI signal before execution. Additionally, the physical platform was customized using 3D-printed components designed in Fusion 360, and Visual-Inertial Odometry (VIO) was integrated to enable robust indoor localization.

## Languages

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|---|---|
| Italian | Native |
| English | B2 |

## Tech Skills

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|---|---|
| **Operating Systems** | Windows, Ubuntu (Linux) |
| **Control Theory & Systems** | Analysis and design of linear and nonlinear systems, Optimal control, State estimation, Digital control systems, Geometric control of UAVs, Control Barrier Functions for safety-critical control, Force control for Human-Robot interaction |
| **Programming & Software Tools** | MATLAB/Simulink, Python, Arduino IDE, LTSpice, LaTeX, Microsoft PowerPoint, Word |
| **Robotics & Control** | Stateflow, Robot Kinematics, PX4 Autopilot, ROS, jMAVSim, QGroundControl, Visual-Inertial Odometry (VIO) |

**Hardware & Design** Circuit Board Soldering Printed Circuit Board Design (EAGLE), Autodesk Fusion 360

**Machine Learning** Supervised & Unsupervised Learning, Model Reduction (DMD), Reinforcement Learning, Neural Network

## Soft Skill

Highly motivated and committed to continuous learning and self-improvement, Strong ability to work in teams, with experience in coordinating and motivating group members, Adaptable and open to acquiring new knowledge and skills quickly, Critical thinker with a proactive approach to problem solving, Strong sense of responsibility and dedication to delivering high-quality results.

## Additional Information

**Driving License** Full European AM, B