

# Francesco Russo

*Electronic Engineer & student in Control Engineering*

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in francesco-russo-MSc

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## Education

- 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

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## Academic Work-Projects

### **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.

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### **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.

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### **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.

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### **MIMO Analysis:**

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

### *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 between 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

Italian	Native
English	B2

## Tech Skills

<b>Operating Systems</b>	Windows, Ubuntu (Linux)
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<b>Control Theory &amp; Systems</b>	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
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<b>Programming &amp; Software Tools</b>	MATLAB/Simulink, Python, Arduino IDE, LTSpice, LaTeX, Microsoft PowerPoint, Word
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<b>Robotics &amp; Control</b>	Stateflow, Robot Kinematics, PX4 Autopilot, ROS, jMAVSim, QGroundControl, Visual-Inertial Odometry (VIO)
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**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

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### 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.

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### Additional Information

**Driving License** Full European AM, B