SIMONE ORELLI

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SUMMARY

Control Systems Engineer and PhD student (ABRO, Sapienza University of Rome) with a strong interest in nonlinear and geometric control, robotics, and autonomous systems. I enjoy working across the full pipeline, from modeling and simulation to experimental validation, combining theory with hands-on development. My interests include aerial robotics, physical interaction, estimation and sensing, and machine learning for robotics. Driven by curiosity, I continuously explore new topics at the intersection of mathematics, physics, and engineering. Outside of work, I enjoy playing guitar, sports, and chess.

EDUCATION

PhD, Automatic Control, Bioengineering and Operations Research (ABRO) — *2025 - 2028 (expected)*
Sapienza Università di Roma, Rome, Italy — *Cycle: 41st*

M. Eng. equivalent, Control Engineering (LM-25) — *Nov 2021 - Jul 2025*
Sapienza Università di Roma, Rome, Italy — *Final grade:* 110/110 *with honors*
Thesis: *Nonlinear geometric control of partially-coupled underactuated floating vehicles* — *Supervisor: Antonio Franchi*

B. Eng. equivalent, Information Engineering (L-8) — *Sep 2016 - Oct 2021*
Sapienza Università di Roma, Latina, Italy — *Final grade:* 110/110 *with honors*
Thesis: *Markovian and Semi-Markovian Stochastic Processes* — *Supervisor: Costantino Ricciuti*

Technical Institute: Business Information Systems — *Sep 2011 - Jul 2016*
ISIS Pacifici & De Magistris, Sezze (LT), Italy — *Final grade: 100/100*

EXPERIENCES

Research Engineer - SOAR-TOUCH (EU-funded Research Grant) — *Aug 2025 - Present*
EU-funded collaboration between DIAG (Sapienza University of Rome) and Robotics and Mechatronics (University of Twente), developing robust and energy-aware force-based control for aerial robotic manipulation using Soft Optical Tactile (SOT) sensing. [Project website] — *Sapienza University of Rome (DIAG) + University of Twente (RAM)*

- Design and validation of force-based control strategies enabling stable and safe contact with the environment using SOT sensing, while minimizing pushing force and energy consumption.
- Robustness-oriented development and testing under exogenous disturbances (e.g., wind / external perturbations), bridging simulation and real experiments.
- Development of reliable simulation pipelines (MATLAB/Simulink) and experimental procedures for measurement and validation.
- Data acquisition and synchronization (tactile images, forces, poses); automation and analysis in Python.
- CNN-based real-time inference pipeline for estimating interaction forces directly from tactile images.
- Ongoing research period at the University of Twente (international collaboration and experimental methodologies).

Autopilot Control Systems Engineer — *Sep 2024 - May 2025*
Partner of "Sapienza Aerospace Student Association - SASA" for the project "Sapienza Flight Team - SFT". — *Sapienza University of Rome Faculty of Engineering*

- Contributed to the design and implementation of a geometric tracking controller for autonomous vertical flight of a VTOL tricopter, including stabilization and management of flight transitions.

Tutoring activity — *Sep 2022 - Dec 2022*
Tutor for the course *Fondamenti di Automatica I: Teoria dei Sistemi* under the supervision of Mattia Mattioni. — *Sapienza University of Rome Latina campus*

- Developed exercises and didactic material supporting the course topics; classes held during the first semester of the 2022/2023 academic year.

Universal Civil Service *Sep 2021 - Sep 2022*
Volunteer Operator *Municipality of Sezze*

- Support to adults and elderly people in difficult conditions.
- Assistance at municipal offices for initiatives promoted for social services.
- Support for public events to promote and protect the territory.
- Carried out project tasks ensuring understanding and achievement of the objectives set.

TECHNICAL SKILLS

Software and tools	Microsoft Office, Simulink, Stateflow, Blender, Autodesk Fusion 360, Cisco Packet Tracer
Programming languages	Arduino, Assembly, C, C++, Java, MATLAB, Python (ML/CNN pipelines), Visual Basic
Web languages	CSS, JavaScript, LaTeX, PHP, XHTML, XML
Databases	E/R scheme, MariaDB, Microsoft SQL, MySQL

LANGUAGE SKILLS

Italian	Native
English	B2 (Self-assessed)
French	A2 (Basic)
Spanish	A2 (Basic)

ACADEMIC PROJECTS

Details and media at r-orelli.eu

Nonlinear geometric control of partially-coupled underactuated floating vehicles *Winter - Spring 2024/2025*
Master's thesis on static hovering of generically tilted multirotor platforms (GTMs) on $SE(3)$, with emphasis on partially coupled underactuated vehicles. Starting from a general GTM model and the geometric controller, provided a rigorous Lyapunov-based proof of local exponential stability of the closed-loop error dynamics, filling a gap left by prior experimental-only validations. The analysis uses nonlinear control and differential geometry in a coordinate-free framework; high-fidelity simulations confirm stability and robustness.

Control of underactuated robots via input-constrained receding-horizon DDP *Winter - Spring 2023/2024*
Co-developed (team of 3) an optimal controller for underactuated robots using Differential Dynamic Programming (DDP) with Levenberg–Marquardt regularisation and MPC-style receding horizon. Validated on pendubot and acrobot, achieving precise tracking under hard torque constraints for highly nonlinear dynamics.

Modeling and simulation of the Mars helicopter "Ingenuity" *Winter - Spring 2023/2024*
Collaborated in a team of 4 to realize a detailed Simulink model of the Ingenuity helicopter flying in the Martian atmosphere.

Self-balancing robot on two wheels *Autumn - Winter 2023*
Worked in a team of 3 to build (including 3D-printed parts), model (MATLAB/Simulink), and control a two-wheeled self-balancing robot in a digital loop with Arduino (stepper motors, MPU6050, Kalman filter, PID).

Decentralized control of the charging process of a fleet of electric vehicles *Winter - Spring 2023/2024*
Collaborated in a team of 3 to develop classical and decentralized MPC strategies for optimal scheduling of a large fleet of plug-in electric vehicles, using a subgradient method for mixed-integer programming.

Control of a video-game race car using a convolutional neural network *Winter 2023*
Designed, trained, and tested (Keras) a convolutional neural network (CNN) to control a race car in OpenAI's Car Racing environment.

Graduation thesis *Summer - Autumn 2021*
Thesis developed with Costantino Ricciuti on Markovian and Semi-Markovian Stochastic Processes.

Web application for delivery leveraging on MySQL DB *Spring - Summer 2021*
Developed (team of 2) a PHP/CSS-based web platform for food delivery, featuring a MySQL database with E/R scheme, state diagrams, and role-based interfaces for customers, restaurants, and riders.

Web application for shipping *Spring - Summer 2021*
Implemented (team of 2) a PHP-developed web platform for shipping services, utilizing CSS and XML for design and data handling; client-server model with distinct roles (clients, couriers, managers, admins) supporting shipment requests and tracking.

Intranet managing *Spring 2020*
Built and configured (team of 2) an intranet in Cisco Packet Tracer (router, switch, HTTP, DNS, FTP, SMTP).

Chat client-server *Autumn - Winter 2019/2020*
Designed and implemented a simple client-server chat application with C++ on Linux (Ubuntu virtual machines).