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Giuseppe Silano

Curriculum Vitae

Via Raffaele Rubattino 54
20134, Milano, Italy
☎ +39 329 954 8196
✉ giuseppe.silano@rse-web.it
🌐 giuseppesilano.net
✉ giuseppe.silano@fel.cvut.cz
👤 [gsilano](#)
📺 [gsilano](#)
Born in Benevento (Italy), on July 23, 1989

Education

- Nov 2020 **Ph.D. Program in Information Technologies for Engineering**, *Group for Research on Automatic Control Engineering (GRACE)*, University of Sannio, Benevento, Italy
- Additional mention of Doctor Europaeus.
 - Focus on robotics, control, path planning and software-in-the-loop.
 - Supervisor: Prof. Dr. Luigi Iannelli.
- Mar 2019 – Nov 2019 **Visiting Ph.D. student at Laboratoire d'Analyse et d'Architecture des Systèmes (LAAS), Robotics and Interactions (RIS) group**, *Centre National de la Recherche Scientifique (CNRS)*, Toulouse, France
- Control of fully-actuated 6DoFs¹ robots with onboard sensors.
 - Supervisor: Prof. Dr. Antonio Franchi.
- Mar 2016 **Master of Science in Electronic Engineering**, *University of Sannio*, Benevento, Italy
- Focus on robotics, control, electronics and telecommunication.
- Jul 2012 **Bachelor of Science in Computer Engineering**, *University of Sannio*, Benevento, Italy
- Focus on robotics, control, software, telecommunication and electronics.
- Feb 2012 – Jun 2012 **Industrial Internship in Systems Engineering**, *Mosaico Monitoraggio Integrato S.r.l.*, Benevento, Italy
- Design a software production methodology using an Object Oriented (OO) approach for Programmable Logic Controllers (PLCs).

Professional Affiliation

- Dec 2016 – Today **IEEE (Institute of Electrical and Electronic Engineers)**, *Student Member (ST'17), Member (M'21)*
- IEEE Control Systems Society (CSS).
 - IEEE Robotics and Automation Society (RAS).

Academic Appointments

- Jul 2022 – Today **Tenured Researcher**, *Department of Generation Technologies and Materials (TGM)*, Ricerca sul Sistema Energetico (RSE) S.p.A., Milan, Italy [RP1], [RP2], [RP3]

¹DoFs: Degree of Freedoms.

- Jul 2022 – Today **Associate Researcher**, *Multi-Robot System (MRS) Group*, Czech Technical University in Prague, Prague, Czech Republic [RP4]
 ○ Working with: Prof. Dr. Martin Saska.
- Jun 2020 – Today **External Collaborator**, *Group for Research on Automatic Control Engineering (GRACE)*, University of Sannio, Benevento, Italy [RP5]
 ○ Working with: Prof. Dr. Luigi Iannelli.
- Jun 2020 – Jul 2022 **Postdoctoral Research Fellow**, *MRS Group*, Czech Technical University in Prague, Prague, Czech Republic [RP4], [M1]
 ○ Supervisor: Prof. Dr. Martin Saska.
- Dec 2019 – Jun 2020 **Research Fellow**, *Group for Research on Automatic Control Engineering (GRACE)*, University of Sannio, Benevento, Italy [RP5], [RP7]
 ○ Supervisor: Prof. Dr. Luigi Iannelli.
- May 2016 – Nov 2016 **Research Fellow**, *Group for Research on Automatic Control Engineering (GRACE)*, University of Sannio, Benevento, Italy
 ○ Supervisor: Prof. Dr. Luigi Iannelli.

Professional Experience

- Jun 2014 – Jun 2023 **Technical Writer**, *Writer of technical articles for magazines and web platforms*, i.e., "Win Magazine", "Ridble", "Firmware", "EOS Book" and "Fare Elettronica", Italy
- Apr 2016 **Junior Software Engineer**, *Software Engine S.r.l.*, Solofra, Avellino, Italy
 ○ Web Developer (specialized in front-end development) responsible for the care (maintenance, debugging) and implementation of HTML5 and CSS3 templates (following the mobile-first responsive and cross browsing), javascript (jQuery, Angular-js) and back-end integration (Java), as well as, management and implementation of relational databases and debugging.
 ○ Projects completed:
 - *Software developer for a management system.* Develop of a software for managing documents presented under the law 219/81 and ss.mm.ii. for the town of Mirabella Eclano.
- Aug 2012 – Jan 2013 **System Integrator**, *Mosaico Monitoraggio Integrato S.r.l.*, Benevento, Italy
 ○ Design and implementation of control systems for industrial automation based on PLC and Supervisory Control And Data Acquisition (SCADA).
 ○ Projects completed:
 - *Storage and loading system of soda autoclaves in autoclaving.* Design and development of the system, and analysis of the control system requirements in accordance to the safety functions.
 - *Leaching process of the blades core for high performance turbines.* Design and development of the system, and analysis of the control system requirements in accordance to the safety functions.

Miscellaneous

- Research Areas Autonomous systems; Unmanned Aerial Vehicles (UAVs) control and navigation; software and simulation-in-the-loop; Temporal Logic (TL); robot manipulators; Model Predictive Control (MPC); communication-aware robotics; human-robot collaboration; formal methods in robotics and automation.

- Skills and expertise **Programming language:** C, C++, Java, Python. **Miscellaneous:** Jekyll, CMake, MATLAB/Simulink. **Robotics Middleware and 3D dynamic simulation environments:** Robot Operating System (ROS), Generator of Modules (GenoM), Gazebo, V-REP, MATLAB Virtual Reality Toolbox. **Markup languages:** Markdown, reStructuredText (RST), \LaTeX . **Distributed version control systems:** Mercurial, Git. **Continuous integration systems:** Jenkins, GitHub Actions, TravisCI. **Optimization tools:** Gurobi, CasADi, CVX, IPOPT, qpOASES, YALMIP, MATMPC, Optimization Engine (OpEn), CPLEX.
- License **Aircraft Pilot's License**, Remote Piloting Media Vehicles Regulation, VL/Mc class, Aeroclub of Benevento Gen. Nicola Collarile, Benevento, Italy, April 2017
- Open-source Dev. Contributor, author, and maintainer of open-source projects:
- Among the authors and maintainer of the \TeX repository “europecv”. Comprehensive TEX Archive Network (CTAN) profile available at <https://ctan.org/home/g.silano>.
 - Contributor of the styles, RotorS, bebop_autonomy, NMPC strategy for Autonomous Vehicles, Vision-Based Path Following Algorithm, ros-travis-integration, kaobook, MATMPC packages, templates and draw examples in \LaTeX .
 - GitHub and Gist profiles: <https://github.com/gsilano> and <https://gist.github.com/gsilano>, respectively.

Research Activities

Path planning algorithms for the inspection of civilian infrastructure with multi-robot systems

Within the Aerial-Core European project [RP4]², path planning algorithms aimed to compute feasible and constrained trajectories for a fleet of UAVs leveraging on Signal Temporal Logic (STL) specifications have been investigated. The planner allows to formulate rather complex missions avoiding obstacles and forbidden areas along the path when also considering vehicle constraints (e.g., maximum velocity and acceleration) [W3]², [J4], [P1]. Besides, a multi-layer software architecture to perform cooperative missions with a fleet of UAVs was designed [C10], [C7], [C5], [C4], [J1], [W2].

Communication-aware robotics

The research activity focuses on “*communication-aware robotics*”, which addresses the challenges of maintaining connectivity and robust information flow in robotic networks. With the increasing importance of robotic networks in various applications, such as emergency response and surveillance, wireless communication plays a crucial role in connecting UAVs with other nodes or remote operators. The main motivation behind this research is to develop methods and algorithms that enable UAVs to explicitly consider communication link qualities during motion planning. In this context, a framework to generate feasible dynamic trajectories for multi-rotor UAVs relay while considering their motion dynamics and the motion-induced by changes of the

²The research activity was partially carried out also within the Comp4Drones European project [RP5].

antenna orientation was also proposed [C8], [C2].

Model Predictive Control (MPC) strategies for motion control of aerial robots

Within the Aerial-Core European project [RP4], Model Predictive Control (MPC) strategy aimed at performing vision-based target tracking and collision avoidance with a multi-rotor aerial vehicle have been investigated. The proposed control strategy considers both realistic actuation limits, visual perception and obstacle avoidance constraints [C6]. The research activity investigated approaches for achieving decentralized collective navigation of UAV swarms. The approach is based on the flocking and collective navigation behavior observed in natural swarms, such as cattle herds, bird flocks, and even large groups of humans. As global and concurrent information of all swarm members is not available in natural swarms, these systems use local observations to achieve the desired behavior. Simulated and real-world experiments in a natural forest showcase the validity and effectiveness of the proposed collective navigation approach in challenging environments. The source code is released as open-source [J2].

Modeling and control of autonomous vehicles

It has been investigated a Model Predictive Control (MPC) strategy aimed at controlling a small-scale car model for autonomous racing competitions. An optimization problem was set up considering both vehicle's actuation limits and the lateral and longitudinal forces acting on the car described by the Pacejka's Magic Formula and a drivetrain model. The approach allows to safely race on a track populated by static obstacles generating collision-free trajectories and tracking them while enhancing the lap timing performance. The feasibility and effectiveness of the control architecture are demonstrated through closed-loop simulations achieved in Gazebo, specifically using the F1/10 simulator [C3]².

Physical human-aerial robot interaction

Robots aim to aid humans in physically demanding tasks and improve their mental and physical well-being. Collaboration between humans and robots is essential for complex tasks, especially in unstructured environments. However, human-aerial robot interaction remains unexplored due to the potential danger aerial vehicles pose to humans. To this aim, it has been developed a method using high-level specifications expressed in the form of a Signal Temporal Logic (STL) formula to automate task assignments and trajectories for a multi-rotor aerial vehicle performing object handovers in a power line setting while considering human comfort factors such as ergonomics and preferences [C1], [W1].

Control algorithms for autonomously manage production and coordinate agricultural operations

Within the AFarCloud European project [RP7], control techniques aimed to autonomously managing the production and coordinating farming operations

have been investigated, i.e., hierarchical planning algorithms (e.g., RRT, A*, etc.). Specifically, algorithms to coordinate the operations within the farming autonomous activity, thus enhancing productivity and cost reduction, gradually shifting towards a high-level autonomy [C9]², [C12], [J3]².

Flight control of Unmanned Aerial Vehicles

Various activities dealing with UAVs, in particular multi-rotor vehicles, [J5]², [BC1], [C9]², [C11], [C13] and [C14] have been carried out. Software-in-the-loop (SIL) simulation has been investigated as an effective tool for analyzing the behavior of the closed control loop [BC1] and for helping in the design of control strategies [C11].

- **CrazyS:** CrazyS is an extension of the ROS package RotorS, aimed to model, develop and integrate the Crazyflie 2.0 nano quad-rotor in the physics based simulation environment Gazebo. This simulation platform allows to understand quickly the behavior of the flight control system by comparing and evaluating different indoor and outdoor scenarios, with a details level quite close to reality. The proposed extension was developed using Ubuntu 16.04 and the Kinetic Kame version of ROS, but it is also fully compatible with Ubuntu 18.04 along with the Melodic Morenia distribution of ROS and Ubuntu 20.04 along with the Noetic Ninjemys release of ROS. The platform expands the RotorS capabilities by considering the Crazyflie 2.0 physical model, its flight control system and the Crazyflie's onboard Inertial Measurement Unit (IMU), as well. The code has been released as open-source under Apache license (<https://github.com/gsilano/CrazyS>) with the aim to share the obtained results with other researchers who already use such tools and would like to use the platform [BC1], [C13].
- **BebopS:** The repository contains the ROS code developed for the "Aerial robotics control and perception challenge", the Industrial Challenge of the 26th Mediterranean Conference on Control and Automation (MED'18) [A3]. The code aims to simulate the dynamics of the Parrot Bebop 2 together with the flight controller (both high and low level) when external disturbances (e.g., wind gusts) acting on it. The control algorithms were designed in MATLAB/Simulink and validated in Gazebo by using the MathWorks Robotics System Toolbox (MRST). Therefore, the repository contains both ROS nodes and launch files needed to simulate the drone behavior when a tracking algorithm is run. Also, on GitHub the glue code written during the challenge to tackle the tracking problem with the real platform is available. Such code allows to send control commands and to receive data from the aircraft and the Motion Capture (MoCap) systems, i.e., Vicon. Finally, the repository contains the developed ROS code to connect the control algorithm to the Parrot Sphinx simulator including the Parrot Bebop onboard firmware in the loop. In this way, details like synchronization, timing issues, fixed point computation, overflow, divisions-by-zero, can be isolated and investigated in detail [C11]. The code has been released as open-source under Apache license at the link <https://github.com/gsilano/BebopS>.

- **MAT-Fly:** MAT-Fly is a numerical simulation platform for multi-rotors aircraft characterized by the ease of use and control development. The platform is based on MATLAB and the MathWorks Virtual Reality Toolbox (MVRT) that work together to simulate the behavior of a drone in a 3D environment while tracking a car that moves along a nontrivial path. The MVRT toolbox has been chosen due to the familiarity that students have with MATLAB and because it allows to move the attention to the classifier, the tracker, the reference generator and the trajectory tracking control thanks to its simple structure. The overall architecture is quite modular so that each block can be easily replaced with others by simplifying the development phase and by allowing to add even more functionalities. The code is released under Apache license and made available at the links <https://github.com/gsilano/MAT-Fly> and <https://www.mathworks.com/matlabcentral/fileexchange/72486-mat-fly>, thus making the numerical platform available for scientific and educational activities [J5], [C14].

Mohamed Bin Zayed International Robotics Challenge (MBZIRC) 2020

The Mohamed Bin Zayed International Robotics Challenge (MBZIRC) is a biennial international robotics competition that provides an ambitious and technologically demanding set of challenges and is open to all teams from all countries. Also, the MBZIRC competition aims to inspire future robotics through innovative solutions and technological excellence. Within the competition, specifically the “challenge 2” of the 2020 edition, autonomous aerial and ground robots have been carried out for navigation and manipulation tasks, in unstructured, outdoor and indoor environments. In particular, a team of UAVs and a Unmanned Ground Vehicle (UGV) collaborating to autonomously locate, pick, transport and assemble different types of brick shaped objects to build pre-defined structures, in an outdoor environment. The challenge is motivated by construction automation and autonomous robot based 3D printing of large structures. This research activity has been carried out during the visiting period spent at LAAS-CNRS in Toulouse [A2], [W4].

Research Projects

- [RP1] **Participation within H2020-2019-1-RIA - INFRAIA**, *European Research Infrastructure supporting Smart Grid Systems Technology Development, Validation and Roll Out (ERIGRID2)*, research project agreement 870620, Project Advisor for the Ricerca sul Sistema Energetico (RSE) S.p.A.: Eng. Riccardo Lazzari, Role: work package leader (WP13 – JRA4), October 2022 – Today
- [RP2] **Participation within HORIZON-CL5-2021-D5-01-RIA**, *Flexible energy systems Leveraging the Optimal integration of EVs deployment Wave (FLOW)*, research project agreement 101056730, Project Advisor for the Ricerca sul Sistema Energetico (RSE) S.p.A.: Eng. Filippo Colzi, Role: participant, July 2022 – Today

- [RP3] **Participation within the research fund for the Italian Electrical System, Vehicle-to-Grid (V2G) project**, financed under the contract agreement between RSE S.p.A. and the Ministry of Economic Development - General Directorate for the Electricity Market, Renewable Energy and Energy Efficiency, Nuclear Energy, Project Advisor for Ricerca sul Sistema Energetico (RSE) S.p.A.: Eng. Carlo Sandroni, Role: participant, July 2022 – Today
- [RP4] **Participation within H2020-2019-2-RIA-two stages - ICT, AERIAL COgnitive integrated multi-task Robotic system with Extended operation range and safety**, research project agreement 871479, Project Advisor for the Czech Technical University in Prague: Prof. Dr. Martin Saska, Role: leader from CTU side (June 2020 – July 2022), participant (July 2022 – Today)
- [RP5] **Participation within H2020-2018-2-RIA-two-stages – ECSEL, Comp4Drones, Software Components For Drones**, research project agreement 826610, Project Advisor for the University of Sannio: Prof. Dr. Luigi Iannelli, Role: participant, October 2019 – May 2023
- [RP6] **Participation within the Mohamed Bin Zayed International Robotic Challenge (MBZIRC) 2020**, Project Advisor: Prof. Dr. Antonio Franchi, Role: member of the Laboratoire d'Analyse et d'Architecture des Systemes (LAAS) team, March 2019 – December 2019
- [RP7] **Participation within H2020-2017-2-RIA-two-stages – ECSEL, AFarCloud, Aggregate Farming in the Cloud**, research project agreement 783221, Project Advisor for the University of Sannio: Prof. Dr. Luigi Glielmo, Role: participant, September 2018 – June 2020

Research Visits

- 2022 November 17 — November 30, 2022, University of Twente, Enschede, The Netherlands, Robotics and Mechatronics (RaM) group, Prof. Dr. Antonio Franchi, funded by the TERRINet project, call no. 10.

Scientific Activity³

Editorial Board

- 2023 Member of the Track Program Committee of the 2023 Robotics: Science and Systems (RSS'23). Role: reviewer.
- 2023 Member of the Track Program Committee of the 2023 IEEE 32nd International Symposium on Industrial Electronics (ISIE'23). Member of the Technical Track Committee "TT 03 - Power Systems and the Smart Grid, Renewable Energy Systems and Smart Grid". Role: reviewer.
- 2022 – 2023 Associate Editor of the International Conference on Unmanned Aircraft Systems (ICUAS).

Scientific Societies

- 2023 - Today Member of the IEEE Robotics and Automation Society (RAS) Technical Committee on Smart Buildings
- 2023 - Today Member of the IEEE Robotics and Automation Society (RAS) Technical Committee on Algorithms for Planning and Control of Robot Motion

³Link to the WebOfScience profile: <https://www.webofscience.com/wos/author/record/1668893>.

- 2023 - Today Member of the IEEE Robotics and Automation Society (RAS) Technical Committee on Aerial Robotics and Unmanned Aerial Vehicles
- 2023 - Today Member of the IEEE Robotics and Automation Society (RAS) Technical Committee on Space Robotics
- 2022 - Today Member of the IEEE Robotics and Automation Society (RAS) Technical Committee on Multi-Robot Systems

Edited Books Reviewer

- 2020 Koubaa, Anis (Ed.), "Robot Operating System (ROS) - The Complete Reference (Volume 6)", Springer International Publishing, 2021.
- 2019 Koubaa, Anis (Ed.), "Robot Operating System (ROS) - The Complete Reference (Volume 5)", Springer International Publishing, 2020.
- 2018 Koubaa, Anis (Ed.), "Robot Operating System (ROS) - The Complete Reference (Volume 4)", Springer International Publishing, 2019.

International Journal Reviewer

- 2023 Control Engineering Practice
- 2023 Expert Systems With Applications
- 2022 – 2023 Automatica
- 2021 – 2023 IEEE Robotics and Automation Letters (RA-L)
- 2019 – 2023 IEEE Transactions on Control Systems Technology (TCST)
- 2023 Taylor Francis Cybernetics and Systems
- 2019 – 2023 Springer Journal of Intelligent & Robotic Systems (JINT)
- 2022 – 2023 Field Robotics
- 2021 – 2023 IEEE Access
- 2022 IEEE Vehicular Technology Magazine
- 2022 IEEE Transactions on Automatic Control (TAC)
- 2022 Journal of Field Robotics
- 2021 Journal of Unmanned Vehicle Systems
- 2021 MDPI Energies
- 2021 IET Cyber-Systems and Robotics

International Conference Reviewer

- 2023 International Conference on System Theory, Control and Computing (ICSTCC)
- 2023 Mediterranean Conference on Control and Automation (MED)
- 2023 International Workshop on "Open Source Modelling and Simulation of Energy Systems" (OSMSES)
- 2023 International Federation of Automatic Control (IFAC)
- 2019 – 2023 IEEE European Control Conference (ECC)
- 2020 – 2023 International Conference on Unmanned Aircraft Systems (ICUAS)
- 2021 – 2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
- 2019 – 2020, 2023 IEEE Conference on Decision and Control (CDC)
- 2021 – 2022 IEEE International Conference on Robotics and Automation (ICRA)

- 2021 – 2022 IEEE International Conference on Systems, Man, and Cybernetics (SMC)
- 2021 Workshop on Aerial Robotic Systems Physically Interacting with the Environment (AIRPHARO)
- 2018 – 2019, 2021 IEEE American Control Conference (ACC)
- 2020 – 2021 IEEE International Workshop on Metrology for Aerospace (MAS)
- 2018 IEEE Conference on Control Technology and Applications (CCTA)

Conferences Services

Organized Workshops

- May 2023 **Organizer of the workshop session “The Role of Robotics Simulators for Unmanned Aerial Vehicles”**, *2023 IEEE International Conference on Robotics and Automation (ICRA’23)*, May 29 - June 2, 2023, ExCeL London, UK, together with Dr. Kimberly McGuire, Bitcraze AB, Malmo, Sweden, Dr. Chiara Gabellieri, Robotics and Mechatronics group, Faculty of Electrical Engineering, Mathematics & Computer Science, University of Twente in Enschede, The Netherlands, and Dr. Wolfgang Hönig, Intelligent Multi-Robot Coordination Lab of TU Berlin, Germany. Website: <https://imrclab.github.io/workshop-uav-sims-icra2023>

Invited Talks

- Dec 2022 **Signal Temporal Logics as a Tool to Encode Complex Missions for Multi-Robot Aerial Systems**, *Invited Seminar*, University of Sannio in Benevento, Benevento, Italy
- Apr 2016 **Advanced drone applications: opportunities and problems**, *Make & Share event*, Tech Coffee association, Benevento, Italy

Chairman or co-chairman of international conference sessions

- Jun 2021 2021 International Conference on Unmanned Aircraft Systems (ICUAS’21), Athens, Greece. Role: chair.

Conference Contributions

- Oct 2022 **2022 IEEE International Conference on Systems, Man, and Cybernetics (SMC’22)**, *A Nonlinear Model Predictive Control Strategy for Autonomous Racing of Scale Vehicles*, Prague, Czech Republic, Oral Presentation
- Sep 2021 **Automatica.it 2021**, *national meeting held by SIDRA⁴*, *Optimum Trajectory Planning for Multi-Rotor UAV Relays with Tilt and Antenna Orientation Variations*, Catania, Italy, Oral Presentation
- Jun 2021 **2021 International Conference on Unmanned Aircraft Systems (ICUAS’21)**, *A Multi-Layer Software Architecture for Aerial Cognitive Multi-Robot Systems in Power Line Inspection Tasks*, Athens, Greece, Oral Presentation
- Jun 2021 **2021 IEEE International Conference on Robotics and Automation (ICRA’21)**, *Power Line Inspection Tasks with Multi-Aerial Robot Systems via Signal Temporal Logic Specifications*, Xi’an, China, Oral Presentation

⁴SIDRA: Italian Society of Automatic Control.

- Sep 2020 **Automatica.it 2020**, *national meeting held by SIDRA⁴, A framework for power line inspection tasks with multi-robot systems from signal temporal logic specifications*, Cagliari, Italy, Oral Presentation
- Jun 2018 **26th Mediterranean Conference on Control and Automation (MED'18)**, *CrazyS: a software-in-the-loop platform for the Crazyflie 2.0 nano-quadcopter*, Zadar, Croatia, Oral Presentation
- Sep 2017 **Automatica.it 2017**, *national meeting held by SIDRA⁴, An educational simulation platform for Unmanned Aerial Vehicles aimed to detect and track moving objects*, Milan, Italy, Interactive Session

Teaching Experience

Teaching Assistance

- Sep 2017 – Dec 2019 **Teaching Assistant for Discrete Systems**, *University of Sannio*, Benevento, Italy, Supervisor: Prof. Dr. Luigi Iannelli
- Mar 2016 – Jun 2019 **Teaching Assistant for Automatic Control**, *University of Sannio*, Benevento, Italy, Supervisor: Prof. Dr. Luigi Iannelli
- Sep 2018 – Dec 2018 **Teaching Assistant for Advanced Controls**, *University of Sannio*, Benevento, Italy, Supervisor: Prof. Dr. Luigi Glielmo

Co-supervisor Scientific Activity

- 2020 **MIT Independent Activity Program of Ria Sonecha**, *Software- and hardware-in-the-loop methodologies aimed to test and validate the open-source simulation platform CrazyS*, University of Sannio, Benevento, Italy, Advisor: Prof. Dr. Luigi Iannelli
- 2018 **MIT Independent Activity Program of Benjamin Rodriguez**, *Crazyflie 2.0 model and control for Gazebo 3D simulator*, University of Sannio, Benevento, Italy, Advisors: Prof. Dr. Luigi Glielmo, Prof. Dr. Luigi Iannelli and Dr. Davide Liuzza

Student Supervisor

- 2021 **Bachelor Thesis of Andriy Dmytruk**, *A perception-aware NMPC for collision avoidance and control of a multi-rotor UAV with visual localization constraints⁵*, Ukrainian Catholic University, Ukraine, Advisor: Dr. Giuseppe Silano
- 2021 **Master Project Thesis of Giuseppe Caputo**, *A framework to fulfill inspection missions for a multi-robot system via Linear Temporal Logic specifications*, Czech Technical University in Prague, Czech Republic, Advisor: Dr. Giuseppe Silano
- 2021 **Master Project Thesis of Antonio Lombardo**, *Signal Temporal Logic as a tool to encode inspection missions for a quad-rotor*, Czech Technical University in Prague, Czech Republic, Advisor: Dr. Giuseppe Silano

Student Co-supervisor

- 2017 **Bachelor Thesis of Emanuele Aucone**, *Hovering control for a nano quad-rotor*, University of Sannio, Benevento, Italy, Advisor: Prof. Dr. Luigi Iannelli

⁵The activity has been carried out within an internship program spent at the Czech Technical University in Prague, Czech Republic.

- 2017 **Bachelor Thesis of Francesco Mariano D'Andrea**, *Adaptive control of the vertical dynamics of a drone*, University of Sannio, Benevento, Italy, Advisor: Prof. Dr. Luigi Iannelli
- 2017 **Bachelor Thesis of Olga Napolitano**, *State estimation for a quad-rotor*, University of Sannio, Benevento, Italy, Advisor: Prof. Dr. Luigi Iannelli
- 2017 **Bachelor Thesis of Susanna Maio**, *Analysis of the vertical control of a quad-rotor in the V-REP simulation environment*, University of Sannio, Benevento, Italy, Advisor: Prof. Dr. Luigi Iannelli
- 2016 **Bachelor Thesis of Andrea Mascia**, *Study of the algorithm for the position estimation of a micro UAV*, University of Sannio, Benevento, Italy, Advisor: Prof. Dr. Luigi Iannelli
- 2016 **Bachelor Thesis of Luca De Vincentis**, *Experimental characterization of the flight control system of a micro UAV*, University of Sannio, Benevento, Italy, Advisor: Prof. Dr. Luigi Iannelli

Awards

- [A1] **Among the participants of the UNISANNIO team, winner of the “Math-Works Minidrone Competition at IFAC2020”**, *International Robotics Competition*, organized by MathWorks, Berlin, Germany, Webpage: <https://bit.ly/2VLZZU0>, <http://tiny.cc/46p3pz>
- [A2] **Among the participants of LAAS team [RP6], finalist of the “Mohamed Bin Zayed International Robotics Challenge (MBZIRC)”**, *International Robotics Competition*, organized by the Khalifa University, Abu Dhabi, United Arab Emirates, Webpage: <http://mbzirc2020team.laas.fr/>, <http://mbzirc.com/>, Video: <https://youtu.be/0uWvDbA7Eug>
- [A3] **Finalist of the “Aerial robotics control and perception challenge”**, *26th Mediterranean Conference on Control and Automation (MED'18) Industrial Challenge*, organized by the University of Zagreb, Croatia, ISSN: 1066-033X, DOI: 10.1109/MCS.2018.2888719, URL: <http://dx.doi.org/10.1109/MCS.2018.2888719>

References

Prof. Dr. Luigi Iannelli, Department of Engineering, University of Sannio, Piazza Roma, 21, 82100 Benevento, Italy, luigi.iannelli@unisannio.it.

Prof. Dr. Martin Saska, Faculty of Electrical Engineering (FEL), Czech Technical University in Prague, Karlovo namesti, 13, 12135, Prague 2, Czech Republic, martin.saska@fel.cvut.cz.

Prof. Dr. Antonio Franchi, Faculty of Electrical Engineering, Mathematics & Computer Science, University of Twente, Carré 3609, P.O. Box 217, 7500 AE Enschede, The Netherlands, a.franchi@utwente.nl.

Dr. Davide Liuzza, Department of Engineering, University of Sannio, Piazza Roma, 21, 82100 Benevento, Italy, davide.liuzza@unisannio.it.

Prof. Dr. Luigi Glielmo, Department of Electric Engineering and of Information Technologies, University of Naples, via Claudio, 21, 80125 Naples, Italy, luigi.glielmo@unina.it.

Eng. Carlo Sandroni, Department of Power Generation Technologies and Materials, Ricerca sul Sistema Energetico, Via Raffaele Rubattino, 54, 20134 Milan, Italy, carlo.sandroni@rse-web.it.

Publications

Preprints

- [P1] A. Caballero, and **G. Silano**. "A Signal Temporal Logic Motion Planner for Bird Diverter Installation Tasks with Multi-Robot Aerial Systems", 2022, DOI: 10.48550/arXiv.2210.09750, URL: <https://doi.org/10.48550/arXiv.2210.09750>.

Referred Journals

- [J1] D. Hert, T. Baca, P. Petracek, V. Kratky, R. Penicka, V. Spurny, M. Petrlik, M. Vrba, D. Zaitlik, P. Stoudek, V. Walter, P. Stepan, J. Horyna, V. Pritzl, M. Sramek, A. Ahmad, **G. Silano**, D. Bonilla Licea, P. Stibinger, T. Nascimento, and M. Saska. "MRS Drone: A Modular Platform for Real-World Deployment of Aerial Multi-Robot Systems", Journal of Intelligent & Robotic Systems, pp. 1-34, vol. 108, no. 64, 2023, DOI: 10.1007/s10846-023-01879-2, URL: <https://doi.org/10.1007/s10846-023-01879-2>. IMPACT FACTOR: 3.3.
- [J2] A. Ahmad, D. Bonilla Licea, **G. Silano**, T. Baca, and M. Saska. "PACNav: A Collective Navigation Approach for UAV Swarms Deprived of Communication and External Localization", Bioinspiration & Biomimetics, pp. 1-19, vol. 17, no. 6, 2022, DOI: 10.1088/1748-3190/ac98e6, URL: <https://doi.org/10.1088/1748-3190/ac98e6>. IMPACT FACTOR: 2.985.
- [J3] A. Basiri, V. Mariani, **G. Silano**, M. Aatif, L. Iannelli, and L. Glielmo. "A survey on the application of path-planning algorithms for multi-rotor UAVs in precision agriculture", The Journal of Navigation, pp. 363-384, vol. 75, no. 2, 2022, DOI: 10.1017/S0373463321000825, URL: <https://doi.org/10.1017/S0373463321000825>. IMPACT FACTOR: 1.995.
- [J4] **G. Silano**, T. Baca, R. Penicka, D. Liuzza, and M. Saska. "Power Line Inspection Tasks with Multi-Aerial Robot Systems via Signal Temporal Logic Specifications", IEEE Robotics and Automation Letters, vol. 6, no. 2, pp. 4169-4176, 2021, DOI: 10.1109/LRA.2021.3068114, URL: <http://dx.doi.org/10.1109/LRA.2021.3068114>. IMPACT FACTOR: 3.608. ACCEPTED ALSO TO ICRA'21.
- [J5] **G. Silano**, and L. Iannelli. "MAT-Fly: An Educational Platform for Simulating Unmanned Aerial Vehicles Aimed to Detect and Track Moving Objects", IEEE Access, vol. 9, pp. 39333-39343, 2021, DOI: 10.1109/ACCESS.2021.3064758, URL: <http://dx.doi.org/10.1109/ACCESS.2021.3064758>. IMPACT FACTOR: 3.745.

Referred Book Chapters

- [BC1] **G. Silano**, and L. Iannelli. “*CrazyS: a software-in-the-loop simulation platform for the Crazyflie 2.0 nano-quadcopter*”. In Robot Operating System (ROS): The Complete Reference (Volume 4), Ed. by Koubaa, Anis, Springer International Publishing, 2020, pp. 81–115, ISBN: 978-3-030-20190-6, DOI: 10.1007/978-3-030-20190-6_4, URL: https://doi.org/10.1007/978-3-030-20190-6_4.

Peer-Reviewed Conference Papers

- [C1] **G. Silano**, A. Afifi, M. Saska, and A. Franchi. “*A Signal Temporal Logic Planner for Ergonomic Human–Robot Collaboration*”, 2023 International Conference on Unmanned Aircraft Systems (ICUAS). Lazarski University, Warsaw, Poland, June 2023, pp. 328–335, ISBN: 979-8-3503-1037-5, DOI: 10.1109/ICUAS57906.2023.10156559, URL: <https://doi.org/10.1109/ICUAS57906.2023.10156559>.
- [C2] D. Bonilla Licea, **G. Silano**, G. Ghogho, and M. Saska. “*Communications-Aware Robotics: Challenges and Opportunities*”, 2023 International Conference on Unmanned Aircraft Systems (ICUAS). Lazarski University, Warsaw, Poland, June 2023, pp. 366–371, ISBN: 979-8-3503-1037-5, DOI: 10.1109/ICUAS57906.2023.10155882, URL: <https://doi.org/10.1109/ICUAS57906.2023.10155882>.
- [C3] V. Cataffo, **G. Silano**, L. Iannelli, V. Puig, and L. Glielmo. “*A Nonlinear Model Predictive Control Strategy for Autonomous Racing of Scale Vehicles*”, 2022 IEEE International Conference on Systems, Man, and Cybernetics (SMC). Prague, Czech Republic, October 2022, pp. 100–105, ISBN: 978-1-6654-5258-8, DOI: 10.1109/SMC53654.2022.9945279, URL: <https://doi.org/10.1109/SMC53654.2022.9945279>.
- [C4] D. Hert, T. Baca, P. Petracek, V. Kratky, V. Spurny, M. Petrlik, M. Vrba, D. Zaitlik, P. Stoudek, V. Walter, P. Stepan, J. Horyna, V. Pritzl, **G. Silano**, D. Bonilla Licea, P. Stibinger, R. Penicka, T. Nascimento, and M. Saska. “*MRS Modular UAV Hardware Platforms for Supporting Research in Real-World Outdoor and Indoor Environments*”, 2022 International Conference on Unmanned Aircraft Systems (ICUAS). Drubovnik, Croatia. June 2022, pp. 1264–1273, ISBN: 978-1-6654-0593-5, DOI: 10.1109/ICUAS54217.2022.9836083, URL: <https://doi.org/10.1109/ICUAS54217.2022.9836083>.
- [C5] A. Calvo, **G. Silano**, and J. Capitan. “*Mission Planning and Execution in Heterogeneous Teams of Aerial Robots supporting Power Line Inspection Operations*”, 2022 International Conference on Unmanned Aircraft Systems (ICUAS). Drubovnik, Croatia. June 2022, pp. 1644–1649, ISBN: 978-1-6654-0593-5, DOI: 10.1109/ICUAS54217.2022.9836234, URL: <https://doi.org/10.1109/ICUAS54217.2022.9836234>.
- [C6] A. Dmytruk, **G. Silano**, D. Bicego, D. Bonilla Licea, and M. Saska. “*A Perception-Aware NMPC for Vision-Based Target Tracking and Collision Avoidance with a Multi-Rotor UAV*”, 2022 International Conference on Unmanned Aircraft Systems (ICUAS). Drubovnik, Croatia. June 2022, pp. 1668–1673, ISBN: 978-1-6654-0593-5, DOI: 10.1109/ICUAS54217.2022.9836071, URL: <https://doi.org/10.1109/ICUAS54217.2022.9836071>.

- [C7] L. Demkiv, M. Ruffo, **G. Silano**, J. Bednar, and M. Saska. “*An Application of Stereo Thermal Vision for Preliminary Inspection of Electrical Power Lines by MAVs*”, 2021 Aerial Robotic Systems Physically Interacting with the Environment (AIRPHARO). Biograd na Moru, Croatia. October 2021, pp. 1-8, ISBN: 978-1-6654-3389-1, DOI: 10.1109/AIRPHAR052252.2021.9571025, URL: <https://doi.org/10.1109/AIRPHAR052252.2021.9571025>.
- [C8] D. Bonilla Licea, **G. Silano**, G. Ghogho, and M. Saska. “*Optimum Trajectory Planning for Multi-Rotor UAV Relays with Tilt and Antenna Orientation Variations*”, 29th European Signal Processing Conference (EUSIPCO). Dublin, Ireland. August 2021, pp. 1586-1590, ISBN: 978-9-0827-9706-0, DOI: 10.23919/EUSIPCO54536.2021.9616232, URL: <https://doi.org/10.23919/EUSIPCO54536.2021.9616232>.
- [C9] M. Terlizzi, **G. Silano**, L. Russo, M. Aatif, A. Basiri, V. Mariani, L. Iannelli, and L. Glielmo. “*A Vision-Based Algorithm for a Path Following Problem*”, 2021 International Conference on Unmanned Aircraft Systems (ICUAS). Athens, Greece. June 2021, pp. 1630–1635, ISBN: 978-0-7381-3115-3, DOI: 10.1109/ICUAS51884.2021.9476777, URL: <http://dx.doi.org/10.1109/ICUAS51884.2021.9476777>.
- [C10] **G. Silano**, J. Bedarn, T. Nascimento, J. Capitan, M. Saska, and A. Ollero. “*A Multi-Layer Software Architecture for Aerial Cognitive Multi-Robot Systems in Power Line Inspection Tasks*”, 2021 International Conference on Unmanned Aircraft Systems (ICUAS). Athens, Greece. June 2021, pp. 1624–1629, ISBN: 978-0-7381-3115-3, DOI: 10.1109/ICUAS51884.2021.9476813, URL: <http://dx.doi.org/10.1109/ICUAS51884.2021.9476813>.
- [C11] **G. Silano**, P. Oppido, and L. Iannelli, “*Software-in-the-loop simulation for improving flight control system design: a quadrotor case study*”, 2019 IEEE International Conference on Systems, Man, and Cybernetics (SMC). Bari, Italy, October 2019, pp. 466–471, ISBN: 978-1-7281-4569-3, DOI: 10.1109/SMC.2019.8914154, URL: <http://dx.doi.org/10.1109/SMC.2019.8914154>.
- [C12] P. Daponte, L. De Vito, L. Glielmo, L. Iannelli, D. Liuzza, F. Picariello, and **G. Silano**⁶, “*A review on the use of drones for precision agriculture*”, 2018 1st Workshop - Metrology for Agriculture and Forestry (MetroAgriFor). Ancona, Italy, October 2018, pp. 1–10, DOI: 10.1088/1755-1315/275/1/012022, URL: <http://dx.doi.org/10.1088/1755-1315/275/1/012022>.
- [C13] **G. Silano**, E. Aucone, and L. Iannelli, “*CrazyS: a software-in-the-loop platform for the Crazyflie 2.0 nano-quadcopter*”, 2018 26th Mediterranean Conference on Control and Automation (MED). Zadar, Croatia, June 2018, pp. 352–357, ISBN: 978-1-5386-7891-6, DOI: 10.1109/MED.2018.8442759, URL: <http://dx.doi.org/10.1109/MED.2018.8442759>.
- [C14] **G. Silano**, and L. Iannelli, “*An educational simulation platform for GPS-denied Unmanned Aerial Vehicles aimed to the detection and tracking of moving objects*”, 2016 IEEE Conference on Control Application (CCA). Buenos Aires, Argentina, September 2016, pp. 1018–1023, ISBN: 978-1-5090-0755-4, DOI: 10.1109/CCA.2016.7587947, URL: <http://dx.doi.org/10.1109/CCA.2016.7587947>.

⁶The authors are listed in alphabetic order.

Workshop Contributions

- [W1] **G. Silano**, A. Afifi, M. Saska, and A. Franchi, “*Ergonomic Collaboration between Humans and Robots: An Energy-Aware Signal Temporal Logic Perspective*”. ICRA 2023 Energy Efficient Aerial Robotic Systems Workshop, ExCeL London, UK, June 2023, pp. 1-4, DOI: 10.48550/arXiv.2306.02454. URL: <https://arxiv.org/abs/2306.02454>
- [W2] **G. Silano**, V. Kratky, J. Bednar, M. Vrba, F. Nekovar, D. Bonilla Licea, T. Baca, P. Stoudek, D. Hert, M. Petrlik, D. Smrcka, T. Nascimento, and M. Saska, “*Coordination of a Heterogeneous Team of Aerial Robots to Support Power Line Inspection Operations*”. 2022 International Conference on Unmanned Aircraft Systems (ICUAS). Drubovnik, Croatia. June 2022, contribution accepted for discussion at the tutorial session: “*AERIAL-CORE – Boosting the adoption of aerial robotics in real-world applications*”, DOI: 10.1109/MCS.2022.3209088, URL: <http://dx.doi.org/10.1109/MCS.2022.3209088>.
- [W3] **G. Silano**, D. Liuzza, L. Iannelli, and M. Saska, “*A framework for power line inspection tasks with multi-robot systems from signal temporal logic specifications*”. SIDRA⁴ National Meeting, Cagliari, Italy, September 2020. URL: <https://arxiv.org/abs/2103.02999>
- [W4] A. Afifi, **G. Silano**, M. Tognon, G. Oriolo, and A. Franchi. “*A General Control Architecture for Visual Servoing and Physical Interaction Tasks for Aerial Vehicles*”, MBZIRC Symposium 2020, the First International Robotic Challenges Symposium. Abu Dhabi, United Arab Emirates, February 2020.

Posters

- [P1] **G. Silano**, P. Oppido, and L. Iannelli, “*Software-in-the-loop simulation for improving flight control system design: a quadrotor case study*”. In SIDRA⁴ National Meeting, Ancona, Italy, September 2019. DOI: 10.13140/RG.2.2.31583.61603, URL: <http://dx.doi.org/10.13140/RG.2.2.31583.61603>
- [P2] **G. Silano**, and L. Iannelli, “*An educational simulation platform for Unmanned Aerial Vehicles aimed to detect and track moving objects*”. In SIDRA⁴ National Meeting, Milan, Italy, September 2017. DOI: 10.13140/RG.2.2.14878.43849, URL: <http://dx.doi.org/10.13140/RG.2.2.14878.43849>.

Miscellaneous

- [M1] T. Prihodova, **G. Silano**, A. Ahmad, V. Kratky, T. Baca, P. Petracek, V. Saskova, J. Bednar, and M. Saska. “*2022 IEEE Robotics and Automation Society Summer School on Multi-Robot Systems in Prague [Education]*”, IEEE Robotics and Automation Magazine, vol. 30, no. 1, pp. 104–106, 2023, DOI: 10.1109/MRA.2023.3238213, URL: <https://doi.org/10.1109/MRA.2023.3238213>. IMPACT FACTOR: 5.229.

Theses

- Dec 2016 – Jul 2020 **Ph.D. Thesis**, *Software-in-the-loop methodologies for the analysis and control design of small UAV systems*, University of Sannio, Benevento, Italy
- Show the role and the effectiveness of robotic simulators and Software-in-the-loop methodologies in the flight control system design for multi-rotor vehicles.
 - Advisors: Prof. Dr. Luigi Iannelli.
- Sep 2015 – Mar 2016 **Master Thesis**, *Development of a simulator aimed to detect and track moving objects for UAVs*, University of Sannio, Benevento, Italy
- Design and develop of a 3D simulator aimed to detect and track arbitrary moving objects for UAVs.
 - Advisors: Prof. Dr. Luigi Iannelli.
- Feb 2012 – Jun 2012 **Bachelor Thesis**, *An Object Oriented approach aimed to the creation of control software for industrial processes*, Mosaico Monitoraggio Integrato S.r.l, Benevento, Italy
- Design a software production methodology using an Object Oriented (OO) approach for Programmable Logic Controller (PLC).
 - Advisors: Prof. Dr. Luigi Iannelli and Eng. Paolo Rubino.