

# Frezza Lorenzo

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## EDUCATION

- 2019 - Present  
**PhD student in Aeronautical and Space Engineering,**  
*Sapienza University of Rome*  
Currently PhD Student in Aeronautical and Space Engineering at the Department of Mechanical and Aerospace Engineering.
- 2016 - 2019  
**Master's Degree in Space and Astronautical Engineering,**  
*Sapienza University of Rome*  
Graduated with 110/110 cum laude, with the thesis "In-Orbit data analysis for the attitude determination of the 1KUNS-PF nano-satellite".
- 2013 - 2016  
**Bachelor's Degree in Aerospace Engineering,**  
*Sapienza University of Rome.*  
Graduated with 110/110 cum laude, with thesis concerning the development of the On-Board Data Handling and Ground Station software for a stratospheric balloon payload.
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## WORK EXPERIENCE

- 02/2020 - Present  
**Temporary Research Associate**  
Temporary research associate at Sapienza University of Rome, on the topic of space debris observation based on intercontinental stereo-measurements and attitude determination of the orbital objects.
- 05/2017 - Present  
**On-Board Data Handling, Testing and Integration of LEDSAT**  
Working as responsible for the On-Board Data Handling of LEDSAT as well as aid in Integration and Testing, a CubeSat developed at the S5Lab of La Sapienza - Università di Roma, participating in the ESA programme "Fly your satellite!". The satellite's mission is to test innovative technologies for optical orbit and attitude determination. LEDSAT is a 1-U CubeSat currently in development and set to launch in the year 2020. The role in the team is writing the code for the On-Board Computer and assisting during integration and testing.
- 05/2018 - 06/2020  
**Operator for the 1KUNS-PF nano-satellite**  
Worked as one of the operators of the 1KUNS-PF satellite, managing the spacecraft during in-orbit operations - telemetry management, picture payload data transfer and housekeeping.
- 2019 - Present  
**Development of the WildTrackCube-SIMBA CubeSat**  
Worked on the design, manufacturing of parts and assembly of WildTrackCube-SIMBA. The 1U CubeSat is the winner of the competition "WIN A LAUNCH OF 1U CUBESAT ON THE FIRST COMMERCIAL MISSION OF GK LAUNCH SERVICES!" sponsored by the International Astronautical Federation (IAF) and GK Launch Services. The mission objective is to test innovative tracking solutions for wildlife in Kenyan National Parks.  
The work also included the software development for the on-board

computer and the system-level ambient and environmental testing.

2019 - Present

**Development of the GreenCube CubeSat**

Worked on the design and testing of the bus for the GreenCube CubeSat. Its innovative mission is to test the autonomous growth of micro-vegetables in a CubeSat in MEO orbit in a collaboration between Sapienza, the University of Naples Federico II, ENEA (institute for new technologies, energy and the environment) and the Italian Space Agency.

The work includes the software development and unit testing for the bus subsystems (OBDR, TT&C, EPS, ADCS).

09/2018 – 01/2019

**ERASMUS Programme at UPC**

Spent five months abroad studying at the Polytechnic University of Catalonia (UPC) in Barcelona, Spain.

2018

**Research Fellowship at La Sapienza - University of Rome**

Worked for a research fellowship of 1 month on the satellite subsystem testing of the IKUNS mission.

2018

**Research Fellowship at La Sapienza - University of Rome**

Worked for a research fellowship in collaboration with ASI and INAF on the "Deployment and test of the Sapienza space surveillance network".

2018

**Development of an SDR-based nano-satellite Ground Station**

Developed a Software Defined Radio (SDR) software to receive signals of 1KUNS-PF from the University of Nairobi, Kenya. The development included the realization of a software to receive and demodulate the signal of the satellite, de-scramble and correct broken frames, and finally de-commute the data and distribute them to the GUI software that manages the spacecraft, as well as modulate packets for transmission. In addition, the software necessary to assist reception, such as the controller program to point the antenna towards the satellite and predict its location was developed, as well as the testing equipment and procedures necessary to assess the correct functionality of the antenna and receiving radio.

05/2017 – 05/2018

**Development, Testing and Integration of 1KUNS-PF**

Worked on 1KUNS-PF – the first NanoSatellite of the Republic of Kenya, as main programmer of the On-Board Computer, assisting development, integration and testing that took place in Rome at La Sapienza. 1KUNS-PF is a 1-U CubeSat that was deployed May 11, 2018 from the International Space Station. The satellite is currently in orbit, transmitting picture of the Earth and telemetry. The work included writing all the code necessary to satisfy the CubeSat's mission and aid integration and testing, in particular: Management of the three on-board cameras, packetization of pictures and their transmission; memory management; status control and error correction; parameter management and control via telecommand, failsafe parameter table; simple attitude control logic; de-commutation and interpretation of incoming telecommands; timekeeping; safe antenna deployment algorithm. The work also included the management and remotization of the Ground Station in Rome and Malindi.

2017

**Research Fellowship at Sapienza - University of Rome**

Worked for a research fellowship of 1 month on the "Implementation of new methods for identification, astrometry and photometry software of space debris".

2015 - 2016

**On-Board Data Handling for the STRATONAV Experiment**

Responsible for the On-Board Data Handling and Ground Station systems for the STRATONAV experiment, which flew on the BEXUS 22 stratospheric balloon as part of the REXUS/BEXUS ESA Programme, Cycle 9. The experiment was developed at the S5Lab of La Sapienza - Università di Roma, and aimed at testing the functionality of the VOR (VHF Omnidirectional Ranging) in the stratosphere. The role in the team was to develop a Software Defined Radio (SDR) software to receive and record the VOR frequency spectrum and analyze it at a second time, as well as developing and integrating the system electronics. The analysis consisted of isolation of the single VOR signals, frequency correction due to temperature shifts and demodulation, correlating the VOR radial data with the GPS data; using multiple VOR radials to compute a first-analysis position of the BEXUS balloon.

2012 - 2013

**Main software developer for the Zero Robotics competition**

Worked in the MIT's Zero Robotics competition as the sole programmer for Team Democrito, placing second in the finals, which took place at the European Space Research and Technology Centre (ESTEC) in the Netherlands. The competition required writing 'C' code to control the SPHERES robots inside the International Space Station in order to complete certain tasks. The main difficulty was finding the best strategies and programming the SPHERE in order to execute the movements with a limited processing capability.

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**ADDITIONAL SKILLS**

English language:

UNDERSTANDING		SPEAKING		WRITING
Listening	Reading	Spoken interaction	Spoken production	
C2	C2	C1	C1	C2

Levels: A1 and A2: Basic user - B1 and B2: Independent user - C1 and C2: Proficient user  
Common European Framework of Reference for Languages - Self-assessment grid

Job-related skills:

Good knowledge of several programming languages - including MATLAB, C/C++, C#, Python and scripting languages such as Bash or Javascript.

Proficient in the use of Windows and GNU/Linux operative systems.

Basics of Printed Circuit Board design, manufacturing and component soldering.

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**PUBLICATIONS**

"Usage of Light Emitting Diodes (LEDs) for improved satellite tracking", Acta Astronautica Volume 179, February 2021, Pages 228-237.

"Experimental validation of VOR (VHF Omni Range) navigation

system for stratospheric flight", Acta Astronautica, 2021, 178, pp. 423-431.

"GreenCube: Microgreens cultivation and growth monitoring on-board a 3U cubesat", 2020 IEEE International Workshop on Metrology for AeroSpace, MetroAeroSpace 2020.

"In-orbit autonomous laboratory for microgreens cultivation on a nano-satellite: GreenCube mission", Conference Paper, 70th International Astronautical Congress (IAC).

"Lessons learned from the S5Lab hands-on student activities on the LEDSAT, GREENCUBE and WildTrackCube-SIMBA nanosatellites", Conference Paper, 70th International Astronautical Congress (IAC).

"Testing VOR performances in the stratosphere: the STRATONAV experiment", IAC-16.B2.2.7.x34462, IAC Guadalajara 2016.

"Testing the VOR (VHF Omnidirectional Range) in the stratosphere: STRATONAV experiment", Metrology for Aerospace, 2016 IEEE, Florence (Italy), DOI:10.1109/MetroAeroSpace.2016.7573237, Publication Year:2016

"Assessment of the VHF Omnidirectional Range (VOR) Performance in the stratosphere: STRATONAV on BEXUS 22", 23rd ESA Symposium on European Rocket and Balloon Programmes and Related Research, Visby, Sweden, June 11-15, 2017.

"LEDSAT: an experiment in spacecraft optical tracking using a dedicated observatory network", Advances in Space Research on June 30, 2017.

"Improved Orbit Determination of LEO CubeSats: Project LEDsat", Presented at the Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS).

"VHF Omnidirectional Range (VOR) reliability determination in stratosphere: STRATONAV Experiment". Presented at the 68th International Astronautical Congress (IAC), Adelaide, Australia, 25-29 September 2017.

"Student CEF at Sapienza - University of Rome: Preliminary design of LEDSAT CubeSat". Presented at the 68th International Astronautical Congress (IAC), Adelaide, Australia, 25-29 September 2017.

"Lessons learned from STRATONAV on BEXUS 22: Educational activities on stratospheric balloon experiment development". Second Symposium on Space Educational Activities (SSEA).

"From IKUNS to 1KUNS - First Kenyan University Nanosatellite". Presented at the 68th International Astronautical Congress (IAC), Adelaide, Australia, 25-29 September 2017. Paper code IAC-17,B4,1,12,x41069.

"LEDSAT: A LED-Based CubeSat for optical orbit determination methodologies improvement". 5th IEEE International Workshop on Metrology for AeroSpace, MetroAeroSpace 2018.

"Opportunities and technical challenges offered by a LED-based technology on-board a CubeSat: The LEDSAT mission". 69th International Astronautical Congress, IAC, 2018.

"Design, development, tests and first flight results of 1KUNS-PF, the

first Kenyan University CubeSat". Presented on the 69th International Astronautical Congress (IAC). Paper code IAC-18,B4,1,8,x47886.

"1KUNS-PF after one year of flight: new results for the IKUNS programme". Presented at the 70th International Astronautical Congress (IAC). Paper code IAC-19,B4,1,9,x53881.

"Development and Testing of a LED-based Optical Data Link for the LEDSAT CubeSat", Presented at the 70th International Astronautical Congress (IAC). Paper code IAC-19,B2,2,8,x53908.

"From Stratospheric Experiments to CubeSat Development: Lessons Learned from the S5Lab Participation into ESA Hands-on Educational Programmes". Presented at the 70th International Astronautical Congress (IAC). Paper code IAC-19,E1,3,8,x53875.

"Usage of Light Emitting Diodes for small satellites tracking, early identification after launch and light-based communication". Presented at the 70th International Astronautical Congress (IAC). Paper code IAC-19,A6,10-B4.10,2,x53844.

"Innovative tracking systems test on-board a stratospheric balloon: the STRAINS Experiment". Presented at the 70th International Astronautical Congress (IAC). Paper code IAC IAC-19,B2,4,8,x53632.