Lorenzo Frezza

Email: l

Date of birth: **Nationality:**

WORK EXPERIENCE

[02/2021 – Current]

Temporary Research Associate

Temporary research associate at Sapienza University of Rome, on the topic of attitude determination and control of CubeSats in MEO orbit, with particular application for the GreenCube 3U CubeSat.

[2018 – Current]

Development of the WildTrackCube-SIMBA CubeSat

Worked on the design, manufacturing of parts and assembly of the 1U CubeSat WildTrackCube-SIMBA, launched in March 2021. 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.

[2018 – Current]

Development of the GreenCube CubeSat

Worked on the design and testing of the bus for the GeenCube 3U CubeSat. The work includes the software development and unit testing for the bus subsystems (OBDH, TT&C, EPS, ADCS). The CubeSat is scheduled to be launched in July 2022.

[04/2017 – Current]

On-Board Data Handling, Testing and Integration of LEDSAT

Working as responsible for the On-Board Data Handling of the LEDSAT 1U CubeSat as well as aid in Integration and Testing. The CubeSat was deployed in orbit on August 2021.

[01/2020 – 02/2021]

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.

[04/2017 – 06/2020]

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 CubeSat deorbited in June 2020.

[08/2018 – 01/2019]

ERASMUS Programme at UPC

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

[2018]

Research Fellowship

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.

[2018] **Research Fellowship**

Sapienza University of Rome

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

[2017] **Research Fellowship**

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".

[2014 – 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 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.

[2011 – 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 programming 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.

EDUCATION AND TRAINING

[2018 – 2023] **PhD in Aeronautical and Space Engineering**

Sapienza University of Rome

Final grade: With honors
Thesis: LEDSAT and WildTrackCube-SIMBA: Attitude Determination and Control

[2015 – 2019] **Master's Degree in Space and Astronautical Engineering**

Sapienza University of Rome

Final grade: 110/110 with honors
Thesis: In-orbit data analysis for the attitude determination of the 1KUNS-PF nano-satellite

[2012 – 2016] **Bachelor's Degree in Aerospace Engineering**

Sapienza University of Rome

Final grade: 110/110 with honors

Thesis: OBDH and GS development for stratospheric navigation experiment

LANGUAGE SKILLS

Mother tongue(s): Italian

Other language(s):

English

LISTENING C2 **READING** C2 **WRITING** C2

SPOKEN PRODUCTION C1 **SPOKEN INTERACTION** C1

DIGITAL SKILLS

Programming Languages

C/C++ | Python | C# | Javascript | MATLAB

Other proficiencies

Linux Operating Systems | Git | .NET | MySQL

PUBLICATIONS

[2022]

Satellite early identification through LED observations: First in-orbit results from WildTrackCube-SIMBA

Acta Astronautica, vol. 193, pp. 163–172, 2022, doi: 10.1016/j.actaastro.2022.01.014.

[2021]

Sun direction determination improvement by albedo input estimation combining photodiodes and magnetometer

Acta Astronautica, Sep. 2021, doi: 10.1016/j.actaastro.2021.09.029

[2021]

Vhf omnidirectional range (Vor) experimental positioning for stratospheric vehicles

Aerospace, vol. 8, no. 9, 2021, doi: 10.3390/aerospace8090263.

[2021]

LEDSAT 1U CubeSat GPS receiver Electro-Magnetic Interference (EMI) analysis

8th IEEE International Workshop on Metrology for AeroSpace, MetroAeroSpace 2021, Jun. 2021

[2021]

Distributed hybrid sensors architectures for launch vehicle avionics and future space transportation systems

pp. 7–12. doi: 10.1109/MetroAeroSpace51421.2021.9511749

[2021]

LEDSAT 1U CubeSat thermal analysis and steady state calibration for thermal-vacuum testing

pp. 596–601. doi: 10.1109/MetroAeroSpace51421.2021.9511666

[2021] **Usage of Light Emitting Diodes (LEDs) for improved satellite tracking**

Acta Astronautica, vol. 179, pp. 228–237, 2021, doi: https://doi.org/10.1016/j.actaastro.2020.10.023.

[2021]

Stratospheric balloon tracking system design through Software Defined Radio applications: STRAINS experiment

Acta Astronautica, 2021, doi: 10.1016/j.actaastro.2021.08.006.

[2021]

Autonomous Illumination Payloads for Space Traffic Management: the planned operations of the LEDSAT demonstration mission

IAC 2021 - 72nd International Astronautical Congress.

[2021]

Assembly, Testing, Qualification and planned Operations of the LEDSAT CubeSat mission

IAC 2021 - 72nd International Astronautical Congress.

[2021]

Results of the operation of the PETRUS 1J pulsed plasma thruster unit on GreenCube

IAC 2021 - 72nd International Astronautical Congress.

[2021]

The GreenCube CubeSat mission: Development and Qualification of an autonomous Microgreens Cultivation System and demonstration of CubeSat propulsion in MEO

IAC 2021 - 72nd International Astronautical Congress.

[2021]

The WildTrackCube-SIMBA CubeSat: Italian-Kenyan mission for wildlife monitoring

IAC 2021 - 72nd International Astronautical Congress.

[2021]

Software-Defined Multi-Lateration tracking for near-space, suborbital and space vehicles: development of the STRAINS Experiment

IAC 2021 - 72nd International Astronautical Congress.

[2021]

Innovative observation systems for LEO and GEO orbiting objects state determination

IAC 2021 - 72nd International Astronautical Congress.

[2021]

Experimental validation of VOR (VHF Omni Range) navigation system for stratospheric flight

Acta Astronautica, 2021, 178, pp. 423-431.

[2020]

GreenCube: Microgreens cultivation and growth monitoring on-board a 3U cubesat

2020 IEEE International Workshop on Metrology for AeroSpace, MetroAeroSpace 2020.

[2020]

In-orbit autonomous laboratory for microgreens cultivation on a nano-satellite: GreenCube mission

70th International Astronautical Congress (IAC).

[2020]

Lessons learned from the S5Lab hands-on student activities on the LEDSAT, GREENCUBE and WildTrackCube-SIMBA nanosatellites

70th International Astronautical Congress (IAC).

[2016]

Testing VOR performances in the stratosphere: the STRATONAV experiment

IAC-16.B2.2.7.x34462, IAC Guadalajara 2016.

[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

[2017]

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.

[2017]

LEDSAT: an experiment in spacecraft optical tracking using a dedicated observatory network

Advances in Space Research on June 30, 2017.

[2017] **Improved Orbit Determination of LEO CubeSats: Project LEDsat**

Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS).

[2017]

VHF Omnidirectional Range (VOR) reliability determination in stratosphere: STRATONAV Experiment

68th International Astronautical Congress (IAC), Adelaide, Australia, 25-29 September 2017.

[2017]

Student CEF at Sapienza - University of Rome: Preliminary design of LEDSAT CubeSat

68th International Astronautical Congress (IAC), Adelaide, Australia, 25-29 September 2017.

[2020]

Lessons learned from STRATONAV on BEXUS 22: Educational activities on stratospheric balloon experiment development

Second Symposium on Space Educational Activities (SSEA).

[2017] **From IKUNS to 1KUNS - First Kenyan University Nanosatellite**

68th International Astronautical Congress (IAC), Adelaide, Australia, 25-29 September 2017. Paper code IAC-17,B4,1,12,x41069.

[2018]

LEDSAT: A LED-Based CubeSat for optical orbit determination methodologies improvement

5th IEEE International Workshop on Metrology for AeroSpace, MetroAeroSpace 2018.

[2018]

Opportunities and technical challenges offered by a LED-based technology on-board a CubeSat: The LEDSAT mission

69th International Astronautical Congress, IAC, 2018.

[2018]

Design, development, tests and first flight results of 1KUNS-PF, the first Kenyan University CubeSat

69th International Astronautical Congress (IAC). Paper code IAC-18,B4,1,8,x47886.

[2019] **1KUNS-PF after one year of flight: new results for the IKUNS programme**

70th International Astronautical Congress (IAC). Paper code IAC-19,B4,1,9,x53881.

[2019]

Development and Testing of a LED-based Optical Data Link for the LEDSAT CubeSat

70th International Astronautical Congress (IAC). Paper code IAC-19,B2,2,8,x53908.

[2019]

From Stratospheric Experiments to CubeSat Development: Lessons Learned from the S5Lab Participation into ESA Hands-on Educational Programmes

70th International Astronautical Congress (IAC). Paper code IAC-19,E1,3,8,x53875.

[2019]

Usage of Light Emitting Diodes for small satellites tracking, early identification after launch and light-based communication

70th International Astronautical Congress (IAC). Paper code IAC-19,A6,10-B4.10,2,x53844.

[2019]

Innovative tracking systems test on-board a stratospheric balloon: the STRAINS Experiment

70th International Astronautical Congress (IAC). Paper code IAC IAC-19,B2,4,8,x53632