

Sidhant Kumar

EDUCATION AND TRAINING

PhD Student in Aeronautical and Space Engineering

Sapienza University of Rome [11/2023 - Current]

Master Science Degree in Space and Astronautical Engineering

Sapienza University of Rome [2020 - 16/10/2023]

Final grade: 110 cum Laude | **Thesis:** In Orbit Testing of Attitude Determination and Control System of WildTrackCube-SIMBA CubeSat

Bachelor Degree in Aerospace Engineering

Sapienza University of Rome [2017 – 2020]

Final grade: 110 cum laude | Thesis: Indirect Optimization of a Finite Time Impulsive Rendezvous Manoeuvre

Scientific High School Diploma

Liceo Scientifico Marcello Malpighi [2011 - 2017]

Final grade: 100

PROJECTS

[03/2024 - Current]

Research Collaboration with Telespazio

Key tasks within the collaboration with Telespazio under the Concurrent & Collaborative Design Facility (C2DF):

- Phase 0/A studies for the development of new satellite constellation systems (software development, simulations and trade study of new satellite constellation based on user driven requirements)
- Definition and configuration study of a CubeSat testbed for end-to-end integration

[10/2023 - 04/2024]

Earth Observation and Telecommunication constellation optimization

The activity is carried on at the Sapienza Space Systems and Space Surveillance Laboratory (S5Lab) at Sapienza University of Rome under the supervision of professor Fabrizio Piergentili. The main activities regard the optimization of constellation of of Earth observation constellation for SAR and optical payloads, and telecommunications constellation with particular focus on multi-beam antenna. The task conducted during the project are:

- constellation design
- performance analysis (coverage, revisit time, latency..)
- beam allocation strategy definition
- evaluation of intersatellite link path for ground-space-ground network
- optimization with metaheuristic algorithms (PSO,MOGA)

[10/2023 - 10/2024]

RETINA Mission | BEXUS Programme

The RETINA mission aims to demonstrate the functionality of innovative technologies on a stratospheric balloon. The mission comprises four different experiments: a low-cost real time navigation unit, an AI module for attitude estimation, an innovative thermal cooling system for space applications in a microgravity environment and a flexible time triggered ethernet (FTTE) for real-time communication.

Role and Activites:

- Onboard Software Engineer
- Participation to Selection Workshop at ESTEC (7-11 November 2023)
- Participation to Launch Campaign in Kiruna, Sweden (7-10 October 2024)

[07/2022 - 10/2024]

NIBBIO | Research Project

NIBBIO is a research project supported by the Italian Space Agency (Agenzia Spaziale Italiana - ASI) for the development of hybrid navigation systems.

Role and Activities:

- Student coordinator
- IMU sensor test and integration
- Attitude estimation through Kalman filter

[07/2022 - 12/2022]

LEDSAT 2 | Student Project

LEDSAT 2 is a 3U CubeSat for the extension of LED based technology for ground-based satellite tracking and Space Traffic Management.

Role and Activites:

- Student System Engineer
- Participation to 'Fly Your Satellite!' 4th edition Selection Workshop
- Participation to 'Fly Your Satellite Design Booster' program
- Participation to training week at ESTEC (7-11 November 2022) and Selection Workshop (6-7 December 2022)

[09/2021 - Current]

S5Lab Activities

The main activities conducted as part of the research group of the Sapienza Space Systems and Space Surveillance Laboratory (S5Lab) are:

- CubeSat monitoring and operations (WildTrackCube-SIMBA, Ledsat, Greencube)
- Participation at observation campaigns dedicated at acquiring photometric data of LEDSAT

[09/2021 - Current]

GREENCUBE 3U CubeSat | Research Project

Greencube is a 3U CubeSat developed by Sapienza University of Rome (S5Lab research group) and the Italian Space Agency (ASI), with the participation of the ENEA (Alternative Energy National Agency) and the University of Naples Federico II. Its objective is the autonomous cultivation of microgreens in orbit. The CubeSat was launched on 13/07/2022 with the VEGA-C maiden flight.

Role and Activities:

- CubeSat assembly and integration
- Environmental test campaign for qualification and acceptance to launch
- Technical report writing

[09/09/2020 - 25/07/2021]

LOOPS-M (IGLUNA 2021) | Student Project

LOOPS-M is a project developed for the IGLUNA 2021 program and its objective is the development of a Lunar Operative Outpost for the Production and Storage of Microgreens and interactive Virtual Reality simulation of a Lunar greenhouse.

Role and Activities:

- Design, development and integration of micrometeorite shield based on the model of Stuffed Whipple Shield
- ANSYS hypervelocity impact simulation
- Student technical documentation writing

WORK EXPERIENCE

I Sapienza University of Rome Department of Astronautical, Electrical and Energetic Engineering – Rom e

City: Rome

Autonomous Work Contract - Support to the assembly, integration and test of the EQUO-AD observatory systems

[15/01/2024 - 26/02/2024]

- · development of mechanical interfaces for telescope focusing
- assembly and integration of telescopes
- calibration of telescopes

I Sapienza University of Rome Department of Mechanical and Aerospace Engineering – Rome, Italy

City: Rome | Country: Italy

Collaborative Grant - Support to space surveillance activities for IADC

[01/07/2022 - 30/07/2022]

- Optical observation of WildTrackCube-SIMBA CubeSat with the aim of tracking the satellite and acquiring photometric data generated by the onboard LEDs equipped on the satellite.
- Telescope setup and calibration
- Data processing

Sapienza University of Rome Department of Astronautical, Electrical and Energetic Engineering – Rom e, Italy

City: Rome | Country: Italy

Collaborative Grant - Support to the EQUO-AD observatories

[07/03/2024 - 06/04/2024]

Data analysis for characterization, identification, and determination of space debris orbits

LANGUAGE SKILLS

Mother tongue(s): Italian

Other language(s):

English

LISTENING C1 READING C1 WRITING C1

Hindi

LISTENING B1 SPOKEN INTERACTION B1

SPOKEN PRODUCTION C1 SPOKEN INTERACTION C1

Levels: A1 and A2: Basic user - B1 and B2: Independent user - C1 and C2: Proficient user

HONOURS AND AWARDS

[10/2020]

Path of Excellence Bachelor's Degree in Aerospace Engineering - Sapienza University of Rome

[29/11/2023] UNISEC Global

First Place Mission Idea Contest-UNISEC Global 8th edition with the MOTHS mission (Moon Obeservation Through Hyperspectral Satellites) mission

SKILLS

Microsoft Office (Word, Excel, Powerpoint) / CATIA V5 (CAD) / Matlab / C programming / ANSYS / Global Mission Analysis Tool (GMAT) / FreeFlyer / Git (Github / Gitlab) / Visual Studio Code, Visual Studio / Arduino / Python / Python Language - Basic knowledge / STK (space dynamics) (Basic)

TECHNICAL SKILLS

Good knowledge of orbital dynamics

Good knowledge of space systems and space mission life-cycle

Good knowledge of CubeSat Design Specification

Hands-On experience in Cubesat assembly and environmental testing

SOFT SKILLS

Problem Solving

Analyzing challenges and identifying solutions

Team Working

Effectively contributing to group goals whilst respecting different point of views and leadership in high-pressure environments

Effective Communication

Clearly expressing ideas, listening actively

Time Management

Prioritising tasks, meeting deadlines and efficiently organising workload

CONFERENCES & SEMINARS

[14/10/2024 – 18/10/2024] Milan, Italy **75th International Astronautical Congress**

[18/09/2022 – 22/09/2022] Paris, France 73rd International Astronautical Congress

[24/10/2021 – 28/10/2021] Dubai, United Arab Emirates **72nd International Astronautical Congress**

PUBLICATIONS

[2021]

LOOPS-M Project: Structural and Bioregenerative Systems for a sustainable lunar greenhouse

72nd International Astronautical Congress (IAC) Paper Code: IAC-21,A3,IP,38,x66536

[2021]

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

72nd International Astronautical Congress (IAC) Paper Code: IAC-21,B4,9-GTS.5,5,x66431

[2022]

Designing greenhouse subsystems for a lunar mission: the LOOPS - M Project

Symposium on Space Educational Activities (SSAE)

[2022]

Shared CubeSat Bus Approach for the design and development of the Sapienza S5Lab nano-satellites

IEEE 9th International Workshop on Metrology for AeroSpace (MetroAeroSpace)

[2022]

Autonomous cultivation system for nano platforms: the GreenCube mission

73rd International Astronautical Congress (IAC) Paper Code: IAC-22,B4,6B,4,x73614

[2022]

Microgreens growth tests and space qualification for the GreenCube CubeSat cultivation laboratory

73rd International Astronautical Congress (IAC) Paper Code: IAC-22, B4, 9-GTS.5, 7, x73619

[2022]

First in-orbit operations for the WildTrackCube-SIMBA and LEDSAT 1U CubeSats

73rd International Astronautical Congress (IAC) Paper Code: IAC-22,B4,3,12,x73652

[2022]

Early identification and attitude reconstruction of LED-equipped satellites for Space Traffic Management and improved trackability

73rd International Astronautical Congress (IAC) Paper Code: IAC-22,A6,4,7,x73755

Internet-of-Things sensor applications on the Sapienza S5Lab CubeSats: from wildlife monitoring to intersatellite link research

74th International Astronautical Congress (IAC) Paper Code: IAC-23, B4, 6B, 10, x79893

Advances in spaceborne LED payloads attitude determination and autonomous units design for Space Traffic Management

74th International Astronautical Congress (IAC) Paper Code: IAC-23,A6,4,1,x79847

Lessons learned from the GreenCube 3U CubeSat operations in Medium Earth Orbit

74th International Astronautical Congress (IAC) Paper Code: IAC-23, B4, 3, 2, x79650

[2024]

Evaluation Tool for Hybrid Launch Vehicle Navigation Systems and Measurements Fusion

11th International Workshop on Metrology for AeroSpace (MetroAeroSpace)

[2024]

Light curves sequential comparison strategy for improved understanding of LEO uncontrolled objects

75th International Astronautical Congress (IAC) Paper Code: IAC-24,A6,1,9,x90066

[2024]

CORAL: a 2U CubeSat platform to test TT&C services using Internet-of-Things devices

75th International Astronautical Congress (IAC) Paper Code: IAC-24,B4,6B,13,x90234

[2024]

From Internet of Things to Inter-Satellite Links with the WildTrackCube-SIMBA and CORAL CubeSats

75th International Astronautical Congress (IAC) Paper Code: IAC-24,B2,6,1,x90312

[2024]

Hands-on stratospheric balloon experiment as a stepping stone to the space: the RETINA students' experience

75th International Astronautical Congress (IAC) Paper Code: IAC-24,E1,IPB,8,x90333

[2024]

Stratospheric validation for TRL elevation of hybrid navigation systems, two-phase cooling systems and Alassisted attitude determination for launch vehicles

75th International Astronautical Congress (IAC) Paper Code: IAC-24,D2,6,10,x90336

[2024]

CubeSat technology demonstrators at S5Lab: from Space Traffic Management identification payloads to Internet-of-Things distributed telemetry

75th International Astronautical Congress (IAC) Paper Code: IAC-24,B4,9-GTS.5,7,x91145

[2024]

Telecommunication Constellation Simulator

KA Conference 2024

[2024]

A user-driven trade-space analysis framework for the concurrent design of optimal space mission and system architectures

11 th INTERNATIONAL SYSTEMS & amp; CONCURRENT ENGINEERING FOR SPACE APPLICATIONS CONFERENCE (SECESA 2024)

[2025]

Light curves sequential comparison strategy for improved understanding of LEO uncontrolled objects

Authors: Sidhant Kumar et. al | Journal Name: Acta Astronautica