«'A forz 'e l'ambizione è chell c'avvicin 'e stell a terr»

(«The power of ambition is what brings the stars closer to the ground»)

Co'Sang

Abstract

Prove di citazione [3] perché

Acknowledgments

Thanksss

Contents

List of Figures

List of Tables

List of Abbreviations and Acronyms

LEO	Low Earth Orbit
GMAT	General Mission Analysis Tool
SSO	Sun-Synchronous Orbit
ACT	Actions to Combat Trafficking
ADB	Asian Development Bank
ADS	Agriculture Development Strategy
	...

Chapter 1

Introduction

1.1 Earth Observation and Remote Sensing

1.1.1 Hyperspectral imaging

1.2 Kuva Space

1.2.1 Company Vision

1.2.2 Infrastructure

1.2.3 Distribution

1.2.4 Applications

1.3 Thesis Purpose

1.4 Organization

Chapter 2

Background

This chapter aims to provide a theoretical overview on the fundamentals of Space Flight Dynamics, with a specific focus on Earth Observation applications in Low Earth Orbit (LEO), as well as a literature review on orbit management methods addressed by this thesis work.

2.1 Space Flight Dynamics Overview

Ok [1]

Chapter 3

Methodology

Exclusively open source tools have been used to carry out the thesis work. In particular, the orbital scenarios under examination have been simulated in Python environment. The scripts produced by this research take advantage of existing free Python libraries. Nevertheless, several functions have been written to achieve the purposes of the thesis. Results are always compared with the General Mission Analysis Tool (GMAT). The following paragraphs present a detailed description of the tools mentioned before.

3.1 Python for Astrodynamics Application

Due to the computationally intensive nature of astrodynamics tasks, astrodynamicists have relied on compiled programming languages such as Fortran for the development of astrodynamics software. Interpreted languages such as Python on the other hand offer higher flexibility and development speed thereby increasing the productivity of the programmer. While interpreted languages are generally slower than compiled languages recent developments such as JIT (just-in-time) compilers or transpilers have been able to close this speed gap significantly. Another important factor for the usefulness of a programming language is its wider

ecosystem which consists of the available open-source packages and development tools such as integrated development environments or debuggers. [2]

3.1.1 poliastro Library

3.2 General Mission Analysis Tool

Chapter 4

Satellite Constellation Management Tools

4.1 Orbit Propagators

4.1.1 poliastro Python Library

4.1.2 Atmospheric Models

4.1.3 Mean Orbital Elements Converter

4.1.4 Sun Synchronous Orbits Functions

4.1.5 Satellite Constellation Propagator

4.2 Revisit Time Collector

4.3 Station-Keeping Simulator

4.4 Differential Drag Algorithm

Chapter 5

Case Studies

5.1 Reaktor Hello World

5.2 Hyperfield Next Generation

5.3 Planet CubeSat Constellation

5.4 Future Kuva Constellation

Chapter 6

Analysis and Results

6.1 Reaktor Hello World Life Data

6.2 Hyperfield Orbit Maintenance Design

6.3 Planet Constellation Differential Drag Results

6.4 Kuva Constellation Management Results

Chapter 7

Conclusion

Donec et nisl id sapien blandit mattis. Aenean dictum odio sit amet risus. Morbi purus. Nulla a est sit amet purus venenatis iaculis. Vivamus viverra purus vel magna. Donec in justo sed odio malesuada dapibus. Nunc ultrices aliquam nunc. Vivamus facilisis pellentesque velit. Nulla nunc velit, vulputate dapibus, vulputate id, mattis ac, justo. Nam mattis elit dapibus purus. Quisque enim risus, congue non, elementum ut, mattis quis, sem. Quisque elit.

Bibliography

[1] Anderson, C. *The Space Economy: Capitalize on the Greatest Business Opportunity of Our Lifetime*. Wiley, 2023.

[2] Eichhorn, H., Cano, J. L., McLean, F., and Anderl, R. A comparative study of programming languages for next-generation astrodynamics systems. *CEAS Space Journal 10* (2018), 115–123.

[3] Foster, C., Hallam, H., and Mason, J. Orbit determination and differential-drag control of planet labs cubesat constellations. *arXiv preprint arXiv:1509.03270* (2015).