AE3524 Assignment

Orbit Simulator for Formation Flying

Grgur Dujmović

# Introduction

To start the assignment, the given values are determined. There are two satellites a simulation has to be created for. The following are the given/calculated specifications for each:

**Satellite 1:**

* Size:
  + x – 300mm – 0.3m
  + y – 300mm – 0.3m
  + z – 300mm – 0.3m
* Mass – 30kg
* Orbit height – 500km
* Orbit circular and sun-synchronous, hence inclination ≈ 98o and orbit eccentricity = 0
* **Velocity** ≈ 7.61268km/s
* **Orbital radius (**semi-major axis**)** ≈ 6878km
* **Orbital period** ≈ 1h34m37s

**Satellite 2:**

* Size:
  + x – 300mm – 0.3m
  + y – 300mm – 0.3m
  + z – 300mm – 0.3m
* Mass – 30kg
* **Velocity ≈** 7.61368km/s
* **Orbit height ≈** 498.19km
* Orbit circular and sun-synchronous, hence inclination≈ 98o and orbit eccentricity = 0
* **Orbital radius (**semi-major axis**)** ≈ 6876km
* **Orbital period** ≈ 1h34m35s

# Task 1. Two satellite decaying orbit simulation

To perform this task, a python script was developed to simulate the decaying orbits of the satellites. To calculate the rate of change of orbital altitude, a simplified decay model is used:

r – distance of satellite to Earth centre

α0(r) – sum of accelerations acting on the satellite as a function of r (in this model we only consider atmospheric drag)

T(r) – period of the satellite as a function of r.

To calculate α0, the following equation is used:

ρ(r) – atmosphere density at r distance from origin

v – orbital velocity

cd – drag coefficient

The changes for the orbit height, and mean anomaly are show in Fig1234. The height decay graphs show a change of approximately 1.144m and 1.197m for satellite 1 and 2 respectively over a period of 1 week. The decay happens because of air resistance (drag) that affects the satellite. According to these values, satellite 1 would re-enter in approximately 425 years, and satellite 2 would re-enter in approximately 400 years.

On figures **MEAN ANOMALY** **FIGURES** we can’t see over the span of a week, but reducing the time frame on **FIGURE LOW BOUND** the orbital period can be read out.