

**Politecnico di Milano**  
Dipartimento di Scienze e Tecnologie Aerospaziali  
Prova finale: Introduzione all’Analisi di Missioni Spaziali  
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Elaborato n. C13

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# Introduction

The present project aim is to study, optimize and choose various orbital transfer strategies, having as initial data a point on the initial orbit, which position and velocity vectors are given, and a point on the final orbit, which is defined by its orbital parameters.

First it will be analysed a strategy based on a set of standard maneuvers.

Several other alternative strategies have been examined to try to optimize the two most significant parameters in their distinction: the maneuvering cost (the total speed gap required to complete all the orbital changes) and the operating time (from the start point to the final point).

# Initial orbit characterization

## Initial orbital parameters

The assigned starting position and velocity vectors are the following:

Using MATLAB software, it is possible to calculate the orbital parameters assigned to this specific couple of vectors:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| 83679 | 0.1097 | 48.6244 | 67.8907 | 87.8870 | 103.2729 |

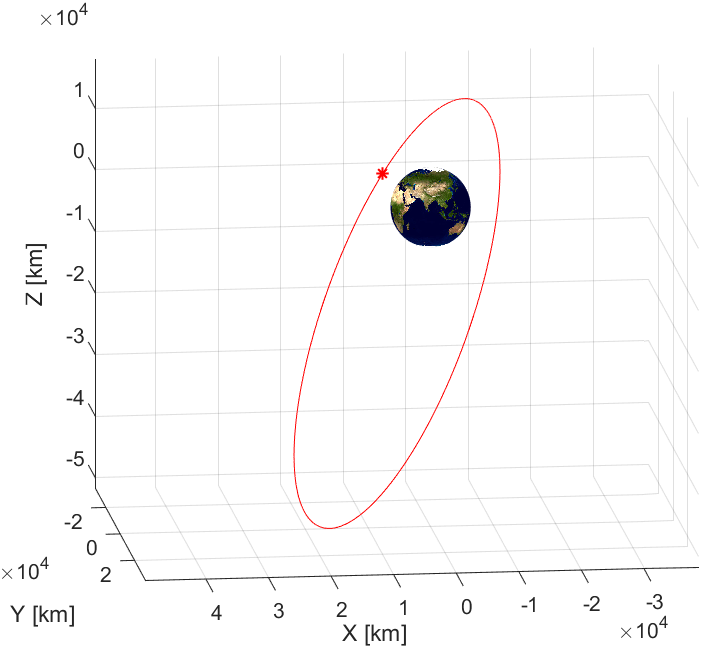
## Data interpretation

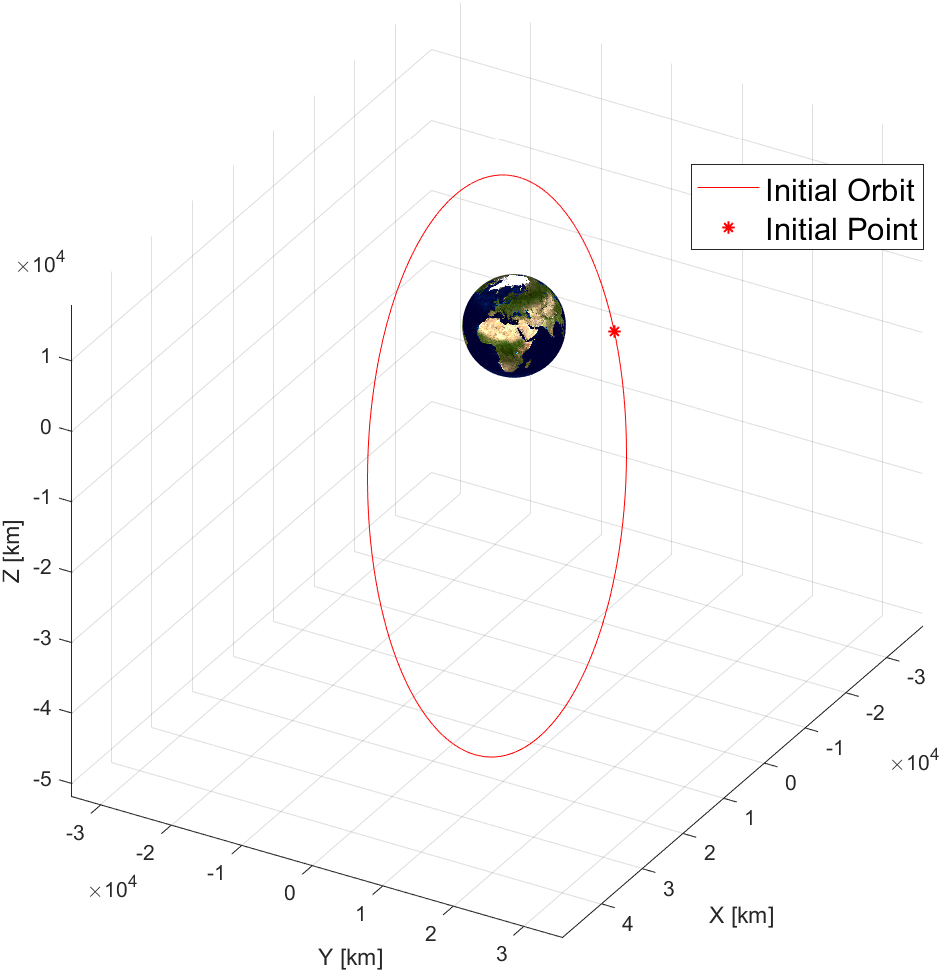
The starting geocentric orbit is elliptical, with an eccentricity value between 0 and 1 and a specific energy of:

It belongs to Medium Earth Orbit (MEO) category, as its apogee and its perigee are inside the range of 8000 – 42000 km:

According to the given value, it is nor a polar nor a geo-synchronous orbit and has a period of:

## Graphical representation

A graphical representation of the orbit is possible with the aid of MATLAB software:



# Final orbit characterization

## Final position and velocity

The goal orbit, that is geocentric just like the starting one, is defined by its orbital parameters:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| 10860 | 0.2332 | 30.2751 | 24.6315 | 173.2051 | 18.9993 |

The final position and velocity are calculated from these parameters using again the MATLAB software:

## Data interpretation

The final geocentric orbit is elliptical, with an eccentricity value between 0 and 1 and a specific energy of:

It belongs to Medium Earth Orbit (MEO) category, as its apogee and its perigee are inside the range of 8000 – 42000 km:

According to the given value, it is nor a polar nor a geo-synchronous orbit and has a period of:

## Graphical representation

A graphical representation of the orbit is possible with the aid of MATLAB software:

# Transfer trajectory definition and analysis

## Standard maneuver

## Alternative maneuvers

## Graphical representation

# Conclusions

# Appendix