AST2000 Project

Simulating satellite launch, space manoeuvring and landing.

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ABSTRACT

The goal of this project is to simulate launching a satellite from our home planet in a semi-randomly generated solar system, manoeuvring it into orbit and landing the satellite on a different planet of choice in the same solar system. Using numerical and analytical calculations, with a set of assumptions and simplifications, the projects main goal is to make a program capable of simulating each step of the journey. The final program was able to take any solar system as input and simulating landing the satellite on any planet of choice within the solar system.

Keywords

Space flight; simulation; numerical calculations.

1. Introduction

Space flight require a lot of precise and complex calculations, with many variables to consider. The size and radius of the planet you are launching from will affect the needed power of your booster rockets and amount of fuel needed to reach solar orbit. In solar orbit, the mass of the planets in the solar system, the mass of the sun and the distances between the satellite and these bodies will \*affect the forces working on the satellite. When landing the satellite, planet size and radius will again have to be considered to determine the size of the landing parachute and reverse boosters.

A realistic space launch, flight and landing are far too complex for the methods used in this project. Realistically, numerous variables would have to be considered i.e weather conditions at launch, gravitational forces from moons, …. To make the project doable\* in the time span and resources we’re allotted, we will make simplifications to our solar system model.

The project will be split up into 10 parts with different milestones.

1. The first part will consist of simulating a simplified rocket engine. The purpose of this part is to calculate the needed size of the rocket engine and the amount of fuel needed to reach our final goal.

*In the first part you are going to simulate a simplified rocket engine to help you calculate the amount of fuel your are going to need to boost the rocket to the required location.*

2. In the second part we will calculate planet orbits and visualize the solar system through a premade 3D-viewer.

*In the second part you will calculate the orbits of all the planets in your star system and visualize the movement.*

3. Successfully calculating the trajectory of the satelitte from our home planet to the chosen planet will be the milsetone of the third part. We will also calculate the boosts needed to navigate the satellite to the destination.

*In the third part you will calculate the trajectory of the satellite from your home planet to your chosen destination. You will also try to find out what instructions to give to the satellite so that it can reach the planet that you want to visit.*

4. The fourth part will consists of making a program that lets the satelitte determine its location and velocity

*In the fourth part you will write the software to allow the satellite to look around and orient itself to find out where it is and what it’s velocity is.*

5.

*In the fifth part you will send the real satellite on its way. You will use the software you made in part 4 to check and correct the calculations that you did in part 2 and 3 along the way to your destination.*

6.

*Once you have reached the intended planet, part 6 will consist of going into a very low orbit above the planet and taking photographs of the surface. You will then choose a nice spot to land.*

7.

*In the last part of the satellite project, you will be launching the lander module from your satellite and try to land it safely on the surface of the planet.*

8.

*In this part you will explore you planet and other parts of the universe with near-light-speed. Here you should collaborate with another student/group where each of you will see events from different frames of reference.*

9.

*In this part you will be travelling to a black hole and together with another student/group you will make experiments close to the event horizon of the black hole.*

10.

*In this final part you will return to your solar system and explore your star*

2. Methods

*The exercises of the different part written up. Equations, code.*

3. Results

4. Conclusion/Discussion

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