UPC Workshop

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October 23, 2020

Intro to UPC

Report Structure

Suggestions and Tips

INTRO TO UPC

Problem A: Protecting Travelers to Mars

One of the challenges of sending humans to Mars is the significant radiation they would experience during the journey. Develop a plan for protecting humans in a spacecraft traveling to Mars from most radiation. To protect a habitable volume of 1,000 cubic meters, how much additional mass would need to be brought on the journey? Provide a careful and thorough evaluation of your plan and its practicality.

Problem B: Design a Roller Coaster

You must design a roller coaster ride to be as exciting as possible, yet safe. The roller coaster will begin with a 20 meter horizontal segment, where passengers board, then climb up a hill to its highest point, taking it to an altitude 30 meters above the starting location. This gravitational potential energy will be the only source of energy for the roller coaster's motion. Precisely describe the path that the roller coaster track would follow, through three-dimensional space, and indicate the orientation of the car as it follows this track. The track must form a closed loop, with the ride ending at the starting location. At no point may the track descend below its starting altitude. Analyze the dynamics of a roller coaster car and determine the total duration of the ride. Use your analysis to make a persuasive case that your design would be safe, but riders would find it to be especially exciting.

Report Structure

1. Abstract
2. Introduction
3. Model
4. Results
5. Discussion
6. Reference
7. Appendix

Abstract

Abstract

In this problem, we are required to design a safe and exciting roller coaster. To solve the problem, we set up a design model of the trajectory with Solid-works and Planet Coaster. Then we derive the equations of motion based on basic dynamic laws. Next with Euler's method, we estimate the solutions and simulate of the roller coaster's motion using MATLAB. For safety and excitement judgement, we define several parameters related to position, velocity, and acceleration to represent the degree of safety and excitement. The value of these parameters and their simulation with time are also obtained with MATLAB. Finally we come to the conclusion that the designed roller coaster is safe and exciting.

Introduction

1 Introduction

Roller coaster is one of the most exciting recreation facilities in amusement park. In this article, we are going to design a roller coaster which is safe and exciting. We will first give a concept diagram of our roller coaster's whole trajectory, then divide it into five parts and analyse them respectively. We are going to use the basic kinematics laws to construct second order ODEs for the motion of the roller coaster car, and apply the Euler Method to obtain an approximate solution for the ODEs, from which we could obtain the velocity and acceleration at any instant of time.

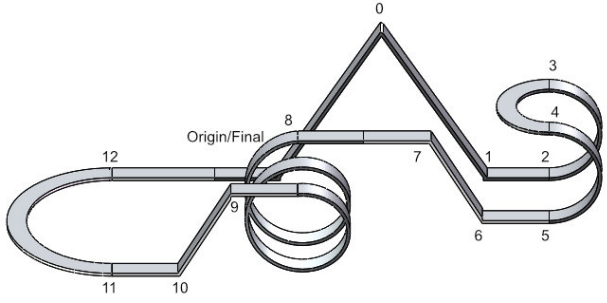
In Model Section, we will first give our method of judgement of safety and excitement, then introduce the basic laws and methods we will use in this project. Moreover, for each part of our trajectory, we will give a simple model with parameters.

In Result Section, we will first give the overall results of our whole model, and give the proof of the safety and excitement. Then we will explain in details about how we obtain the results and the motion of the car in each part of the trajectory.

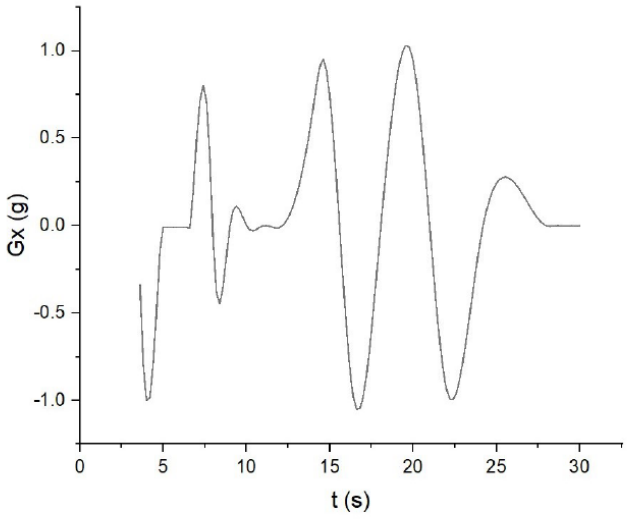
Finally we will draw a conclusion and discuss the limitations and advantages of our model and give some suggestions about how to improve the model.

Model

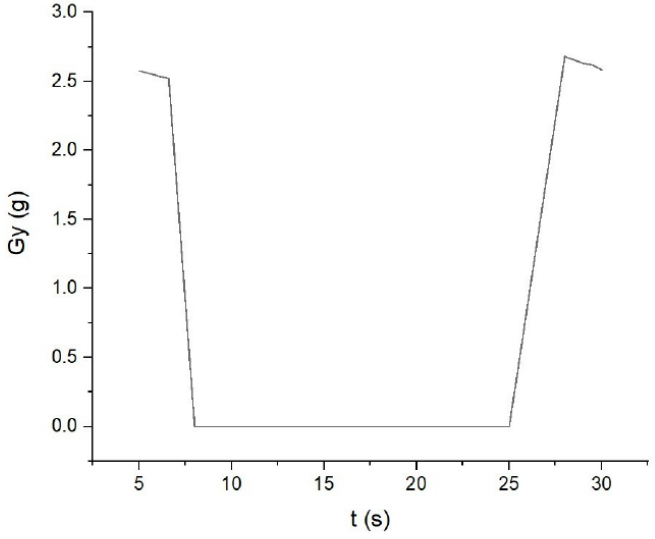
1. Problem Overview
2. Definition
3. Assumptions and Laws
4. Basic Model



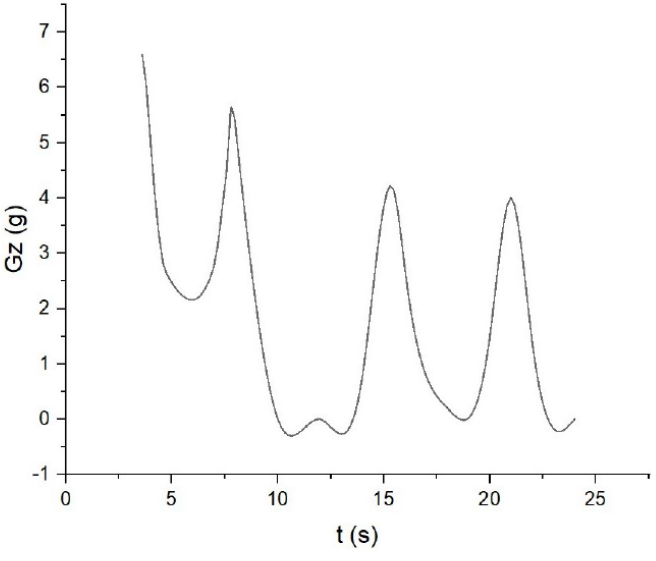
Results



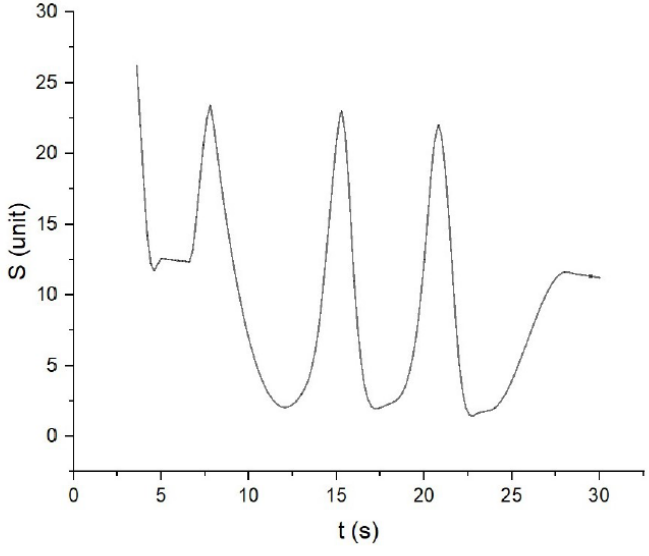
(a) Gx vs t in the whole time interval



(b) Gy vs t in the whole time interval



(c) Gz vs t in the whole time interval



(d) S vs t in the whole time interval

Discussion

1. Conclusion
2. Limitations and Possible Improvement
3. Advantages

Reference

Appendix

1. Plotting Figures
2. Source Codes
3. Tables of Data
4. etc...

Suggestions and Tips

1. Find a coding language that you are best at.
2. Get familiar with the LaTeX system.
3. Developing a clean and neat coding style.
4. Master the basic principles of physics.
5. Choose the problem which you are good at.
6. Have a good rest before the exam(and the first night of the exam).

Hope all of you good grades