User Manual

Roller Coaster

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1. Overview

This program animates a roller-coaster with physics/math simulation. The code is developed in the Microsoft Visual Studio 2013 IDE, but this code is formatted to run under Linux environment. The control keys for the program is as below,
== CONTROLS ==

w	: move forward
s	: move backward
a	: strife left
d	: strife right
q	: move up
e	: move down
arrow left	: rotate to the left
arrow right	: rotate to the right
arrow up	: rotates camera up
arrow down	: rotates camera down
shift+arrow left	: roll camera left
shift+arrow right	: roll camera right
space bar	: pause/play
c	: Switch to first person camera
esc	: exit
Mouse button 1	: Control Camera

2. Features

The features of the assignment are implemented as per requirement based on the Physics/Mathematical theory provided in the tutorial note "CPSC587_RollerCoaster.pdf".

Minimum requirements: The minimum requirement is implemented as a single roller coaster cart moving on a pair of rail.

A pair of rail is implemented using Cubic Bezier Curve by reading a set of control points from a text file. The cart is also being read from a text file as asset of points and then rendering them as a box.

Three phases of the motion are implemented, the initial lifting of the bead along the ascending part of the wire, motion of the bead in the gravity field, and the final deceleration before stopping. In each phases the motion is calculated using the formula provided in the note to simulate in a physically corrected manner.

The animation can be observed from a fixed top view camera which can be moved using the control keys.

For modeling the proper orientation of the pair of rail and cart, the normal, tangent and binormal is calculated. But, there are some issues applying them and may not working properly.

Applying the binormal for framing the track leads to twist in the connecting regions, which may be the caused by improper selection of control point. A twistless track can be rendered by commenting line 318 and 319 and uncommenting line 320 and 321 resulting a twistless but orientationless track. Probably this twist can be removed by selecting proper control points.

The normal is applied to the cart for orientation, which may not be working properly. However, orientation for the cart is present which is evident from the last few moments before stopping.

The motion can be viewed from a camera attached on the on the cart to provide first person view. This mode can be switched using the keyboard key c.