

Falling Plates Simulation

Simulation Project

CMSC 162

Submitted to:

Prof. Sandra Mae Famador

Submitted by:

Manuel Antonio D. Saludadez

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Overview

Introduction

Through the years, computer graphics has been improved in order to produce virtual counterparts of real-life objects. Computer graphics has been used to create models of humans, objects, environment, and etc. It is also used to produce simulations which imitates real-life scenarios to the virtual world. Simulations usually pushes for realism such as earthquake simulations or tsunami simulations; although there are several “simulations” which doesn’t show realism.

The simulation presented in this paper is a simple simulation of falling plates breaking. Plates are dropped on a certain distance and will break depending on how high the plate is from the floor.

Simulation

Mechanics

A rotating plate will be generated to the 3D plane. When the plate is dropped, gravity is applied when it falls to the surface. When it reaches the surface, it breaks when it is dropped on a certain height.

Objects

There are two objects in the simulation: a plate and a floor or surface. The plate is created by putting together several triangles called shards. Each plate has 24 shards where eight of them are used as the middle shards while the remaining are outside shards. The shards are produced using GLUT's GL_POLYGON primitive. The surface on the other hand is created using GLUT's GL_QUADS primitive. A rectangular 3D object is created where the top part serves as the surface where the plate breaks.



Plate



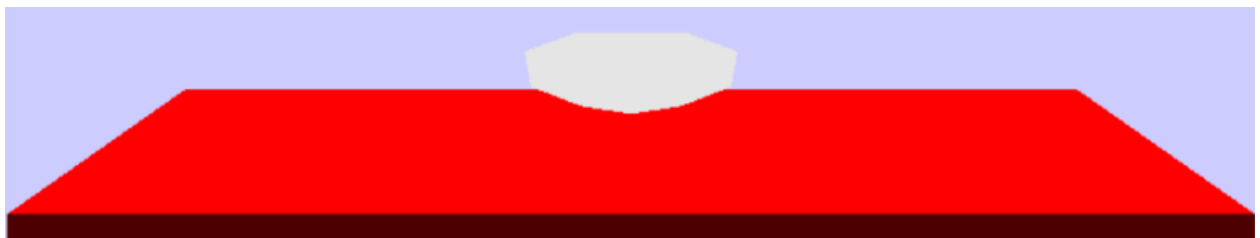
Floor or Surface

Plate Breaking

When the plate is dropped, it falls using the equation

$$\text{height} = 0.01 * (\text{gravity} * \text{time}) - \text{height},$$

where height is the height of the plate from the surface, gravity is the acceleration of the object as it falls down (9.8), and time is the duration of the plate falling to the surface. The breaking of the plate depends on the fall distance of the plate to the surface. A larger distance will break the plate when it falls. When it breaks, the shards which composes the plates are separated in order to produce the “shattered” effect.



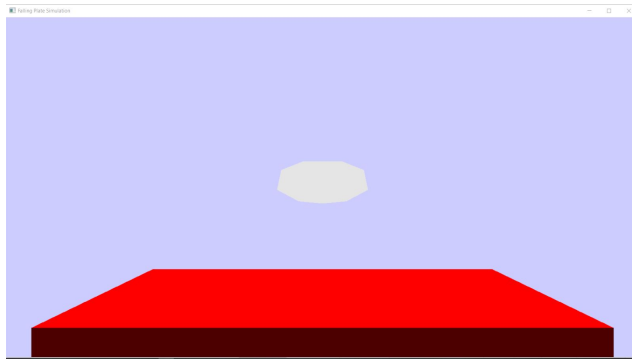
Not Broken



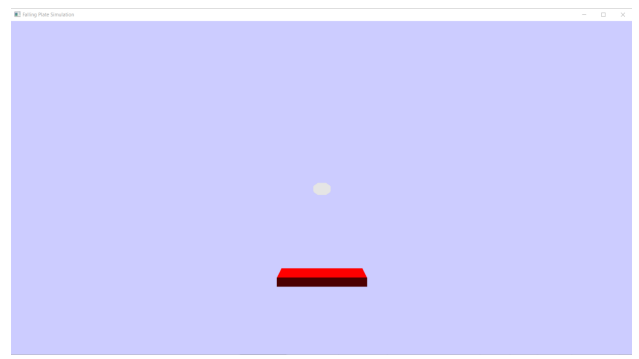
Broken

Changing the Plate and Surface Distance

The distance of the plate and the surface can be changed using the UP and DOWN arrow keys. Pressing UP will increase the distance while pressing down will reduce the distance.



Near



Far

Technical

Language

C++ was used to develop this simulation

Graphics Library

Freeglut (OpenGL Utility Toolkit) was used to render the graphics of the simulation

Classes

Vertex

A point located on an (x,y,z) coordinate. Used as points in Shards.

Shard

A polygon with three vertices. Used for creating a plate.

Plate

A collection of shards combined together. This class is tasked to generate the required shards and draws them. It also checks if the plate reaches the surface or not.