

Billiard Project

Software Development

Emma Santinelli Selena Iskounen Oumayma Khalifi

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Abstract

The goal of this project is to be able to produce videos and widgets representing a point/ball in a billiard with a simple shape and showing its trajectory.

The github repository is available here :

 <https://github.com/emmas2210/Billiard>

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Square Case

Let us start we the simplest case : **The square billiard**

Remark

In this example, we assume that there is no friction and the Descartes rules are satisfied

Parameters set

- size of the square
- ball radius
- an empty word called "collision"
- ball speed (random)
- start angle (random)

Steps

- Creation of the window using tkinter
- Creation of the buttons of the window
- Creation of the ball Canvas widget
- Definition of the movement function

The animations

We have chosen to create two different animations:

- 1 A Canvas Widget where we can interact with the ball with a Python class
- 2 An animation where we use words to analyse the trajectories

We can interact with the ball using the computer mouse :

- left click: grow the ball
- right click: shrink the ball
- clicking on the computer mouse wheel: change the ball's speed and its trajectory.
- "esc" button : leave the animation

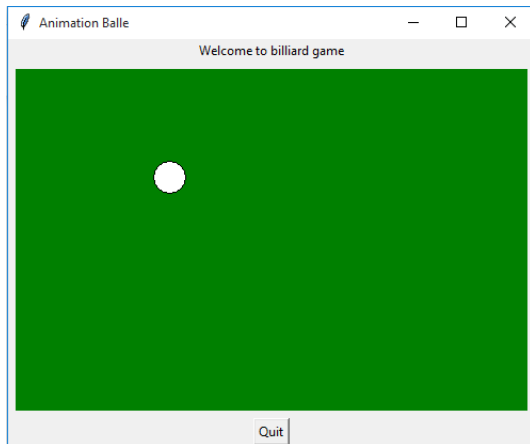
Results of the Canvas Widget



Billiard's animation with words

We start with an empty word. Then, when the ball hit the top or bottom part we add an H (H for horizontal) and when the ball hit the left or right part, we add a V (V for vertical). Then, we perform a statistical analysis of the words creating depending on the angle use to start the trajectory (we restrict to words of size ≤ 2000).

Results of Billiard's animation with words



Word obtained : HVHHHVHHHVHHVHHHVHH

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Remark

A Torus T can be defined by the set :

$$T = \left\{ (x, y, z, w) \in S^3 \mid x^2 + y^2 = \frac{1}{2}, z^2 + w^2 = \frac{1}{2} \right\}$$

where S^3 is a 3-sphere.

Flat Torus Case

Now, we are going to create also with "tkinter" a window. Into this window we are going to create an oval shape which represent our flat torus (torus in 2D) and a ball into this torus. We also, create a button "quit" to quit the game. After, running the code we get the figure below:

Flat Torus Case



Flat Torus Case

We create a code in python to move the ball into the flat torus billiard.
After running the code we get the animation below:

3D Torus Case

Now, we create a ball into a torus in 3d and we get the figure below:

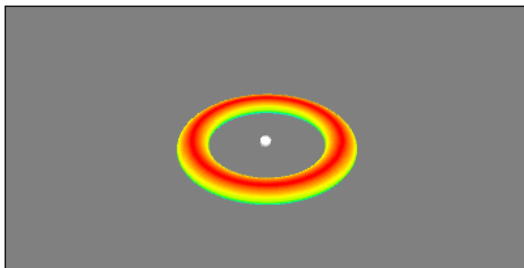


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