Visualization Tool: Oscillation Project Research Document

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Synopsis

Oscillation in its simplest form is easy to understand; periodic motion is natural for even children to comprehend at a basic level. Implementation of these physics, however, is a completely different story. In this document, I will be outlining examples and inspirations I will be using to guide the construction of my project, specifically: Spider-Man games and Cut the Rope. At the end of the document I highlight some other resources I use for my own comprehension, as well as pieces to pull examples from.

Spider-Man Games

Spider-Man is the most prime example of oscillation that is interactive, recognizable, and compelling. The superhero has a pendulum-like swing, using gravity as a harness to fling himself around the city quickly in a way that is on-brand and very enjoyable for the user. This alongside the abilities and influence the player has on movement gives it a very fluid-like feel, while still having the fundamentals of math at its core.

It was not always like this, however. In the very first few games from the franchise, The webs were more of an animation to propel the player forward than they were an example of oscillation. A lot of them didn't even have a valid pivot point, as the web would just appear to be shot directly above Spider-Man into the sky. When technology advanced and more games were released in the early 2000s, the webs started to have genuine physics and pivoted on nearby buildings like we imagine them to.

Below are some examples of the early games that **do not** have oscillation, where the webs were not attached to anything physical and were only an illusion for movement:

To contrast, below are examples from Spider-Man games that **do** have oscillation and properties of physics present in their web-slinging:

The Amazing Spider-Man 2 (2014)

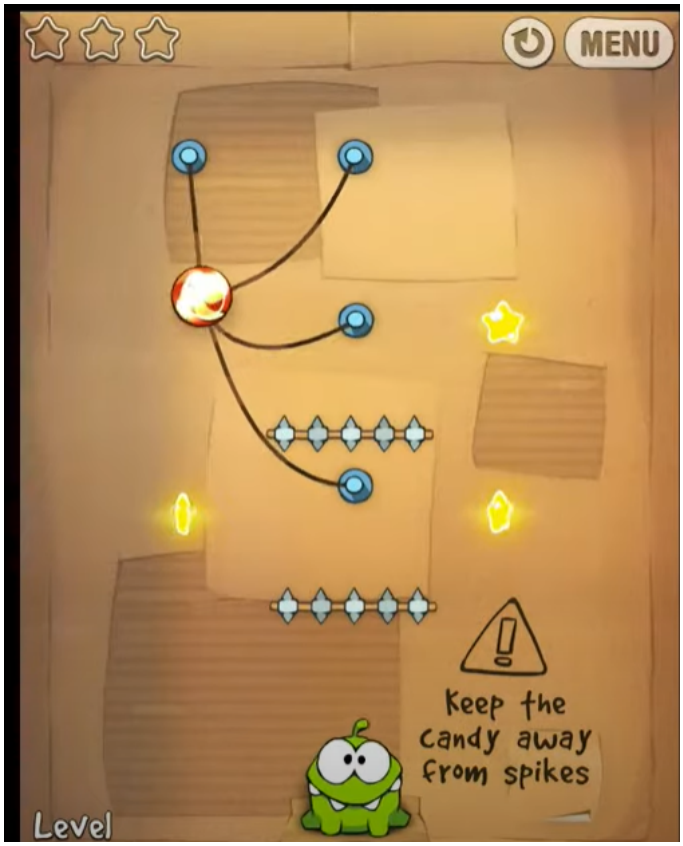
Spider-Man: Miles Morales (2020)

Cut the Rope

Cut the Rope is a unique set of puzzle games that have been around since 2010, showcasing a beautiful display of simplistic physics. The objective is to get the candy to Om Nom, a cute green monster who resides on every level. The player has to interact with the level's environment to influence the candy's position, ultimately collecting bonus stars and securing Om Nom a snack.

Oscillation in this game primarily comes in the form of the candy piece, often being stuck on a rope. The player typically has to use its momentum and pendulum-like movements to their advantage (or disadvantage) to succeed in passing the levels. Other environmental aspects that influence the candy include: bubbles that allow it to float and ignore gravity, balloons that apply a force to it in a specific direction, spikes and other hazards that destroy the candy, and more.

This game, which is targeted at kids, has done a fantastic job about teaching physics in passive ways that are fun. In terms of this project, it also gives a perfect example of damped harmonic oscillation (a simple harmonic motion with damping applied, like friction) and its practicality. Momentum and SHMs are finite in nature without a continuous applied force, as demonstrated.

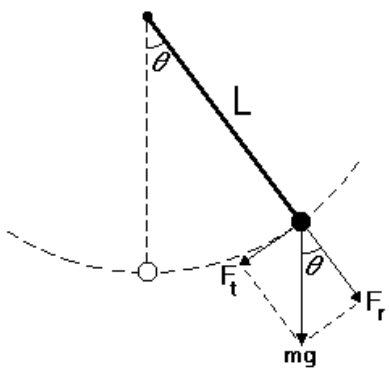

MENU
Keep the
candy away
from spikes
Level

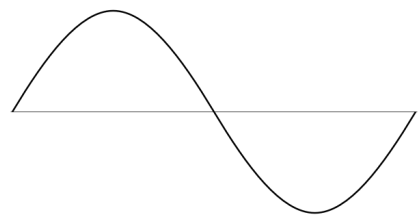
MENU

MENU
Level
2 - 5

Other Resources

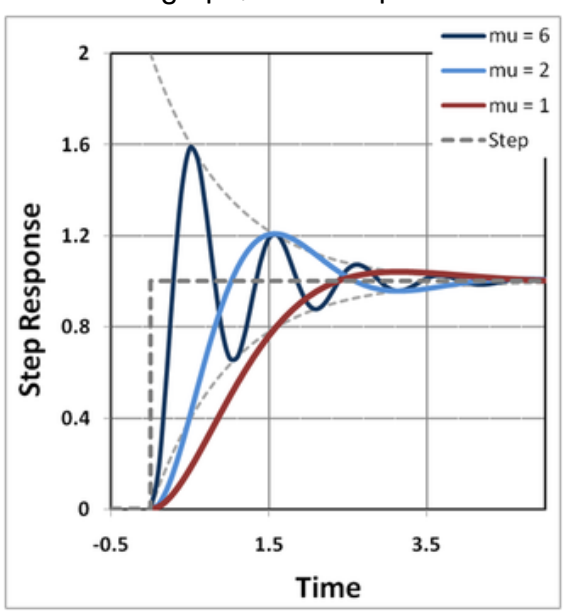
Alongside those two primary, effective displays of oscillation, there are other resources I have used to understand the concepts and basis of the mathematical principle. First and foremost, a pendulum is the most basic form of oscillation and is one of the easiest visuals to instruct with. Next, a sine wave is a perfect example of simple harmonic motion, a type of oscillatory motion.





Furthermore, [this youtube video]() classifies, defines, and shows examples of oscillatory movements and non-oscillatory movements that will be great examples to pull from.

This is a damped harmonic oscillator graph, from wikipedia:



Lastly, I will be using the course book as a resource for mathematics and implementation into processing. Chapter 3 exclusively goes over oscillation and trigonometry.