Flippin' Flingers Trebuchet Progress Report

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1 Abstract

This progress report provides an overview of the ongoing project focused on the sketching, designing, and modeling of a trebuchet.

The report outlines the key milestones achieved since the inception of the project, including initial research on the mechanics of trebuchets, understanding the principles of their operation, and optimizing for distance.

Lastly, the report utilizes rough sketches, CAD, and numerical simulations to guide the construction of the final build.

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2 Introduction

This report's mission statement is to summarize the team's progress with:

- Preliminary design sketches.
- Detailed CAD drawings.
- Numerical modeling details and range predictions.

The problem outline is to design and analyze the trebuchet to maximize projectile distance and accuracy.

The trebuchet is designed for maximum distance through general plane motion.[1] It is also designed for maximum accuracy through string measure.[2]

To maximize distance, the velocity of the projectile is considered, as distance and velocity are proportional. Increasing the counterweight fall distance can boost the projectile's velocity.[3] Increasing the counterweight-to-launch distance increases the velocity of the projectile.[4]

Lastly, adjusting the trebuchet firing angle to 45 degrees achieves the maximum projectile distance.[5]

[1] Hibbeler, 2015
[2] Rhoten, 2021
[3] Siano, 2001
[4] Denny, 2005
[5] Connel, 2001

3 Methodology

The team starts by sketching the trebuchet on engineering grid paper to create a rough visual representation.

Next, the team uses CAD to design the trebuchet, incorporating precise dimensions and measurements. CAD also enables the team to view the trebuchet in 3D, aiding the real-life design process.

Finally, the team utilizes Working Model 2D, a CAE software, to simulate the trebuchet's motion and provide numerical data for analyzing the impact of various factors on its performance.

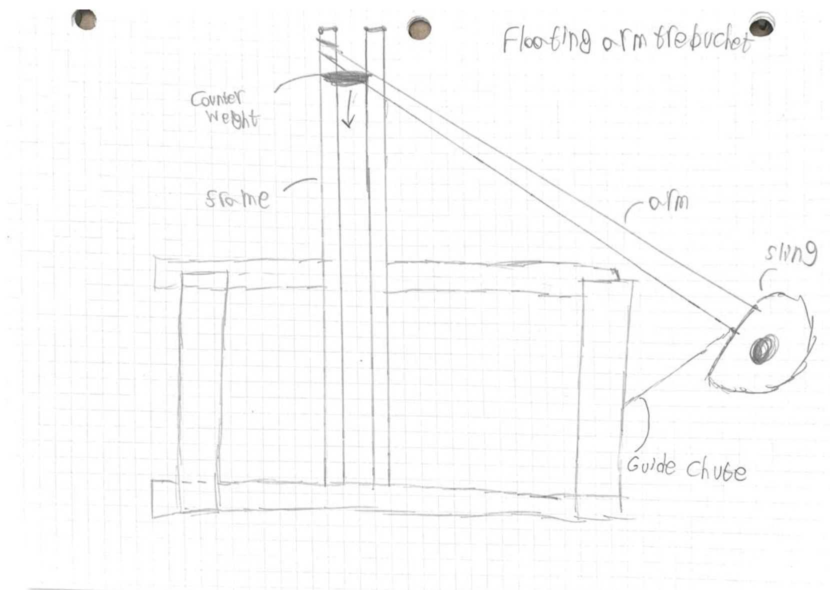

Figure 1: Floating Arm Trebuchet sketch

4 Results

4.1 Sketch

Based on the provided information, the team chose to build a Floating Arm Trebuchet, which is recognized for its unique feature of an axle allowing unrestricted movement on the throwing arm. As a result, the trebuchet exhibits general plane motion. The sketch is shown in Figure 1.

The frame of a trebuchet serves as the structural backbone that supports and stabilizes the entire machine, and the arm is connected to the frame with wooden wheels.

The counterweight is released once the guide chute is triggered. When the counterweight is released, it falls, causing the throwing arm to rotate rapidly around the axle. As the arm swings, the projectile is released from the sling.

4.2 Design

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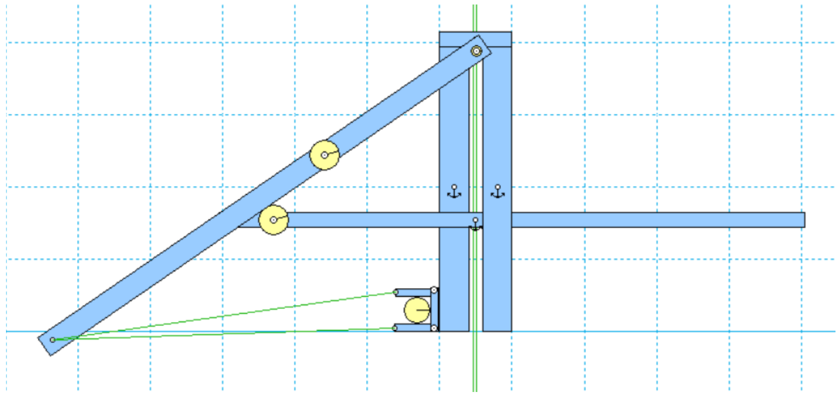

Figure 2: Floating Arm Trebuchet model in Working Model 2D

4.3 Model

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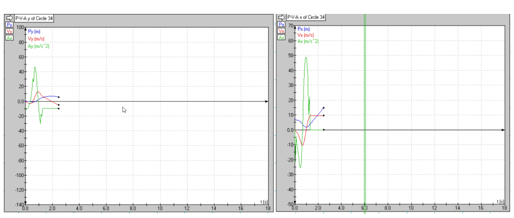

Figure 3: P-V-A graph of ball

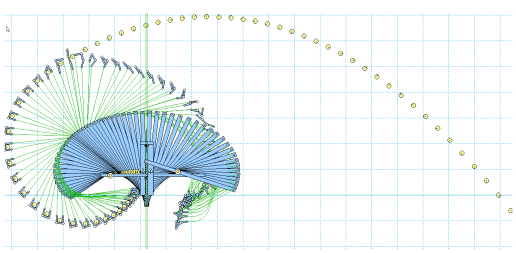

Figure 4: Motion of Trebuchet

5 Conclusions

The main objectives of this milestone were to create a blueprint for the construction of the final build. The key findings are summarized as follows:

1. In order to maximize the distance traveled by the projectile, it is essential to optimize the projectile's velocity.
2. General plane motion increases projectile velocity by harnessing the speed of the falling counterweight.
3. Floating Arm Trebuchets consist of five main components: frame, arm, counterweight, sling, and guide chute.
4. The release of the projectile at a 45 degree angle achieves the maximum projectile distance.

6 References

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