MECHANICAL AND INDUSTRIAL ENGINEERING
COLLEGE OF ENGINEERING
UIC

Slingshot Spider Catapult

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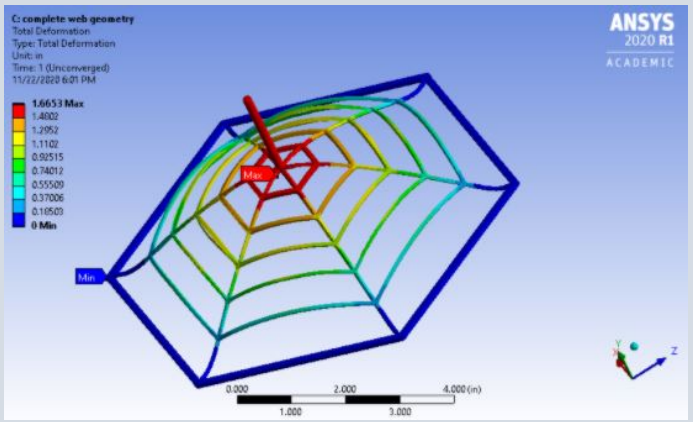
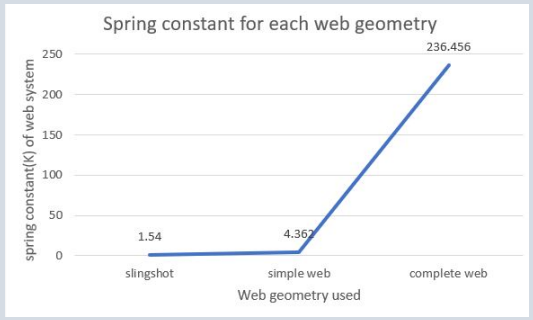
Background

The goal of this project is to create a catapult inspired from the web of a slingshot spider using engineering material that can achieve directional launch with high speed/acceleration. The project is purely for research and results. The slingshot spider can achieve an acceleration of about 130 gs. The goal was to reach 1/10th the acceleration the spider can.

Web Geometry

The web geometry is a large reason why the slingshot spider web can store so much energy. The multiple strands allow for the tension to be evenly distributed throughout the web. This geometry was analyzed using Ansys. Multiple web designs were created, starting from a simple slingshot style design up to a complex web as seen below. A central load was applied, and the deformation was recorded.



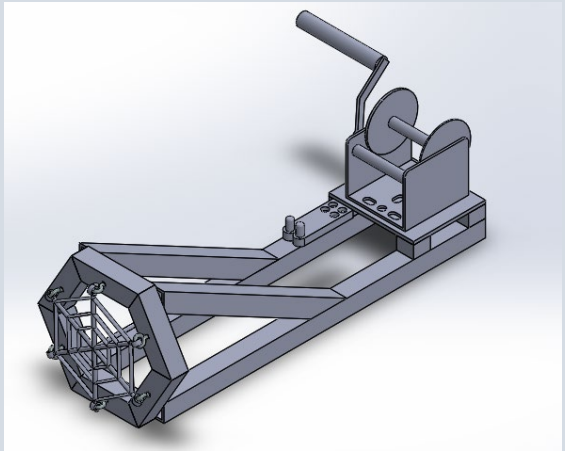


This shows how the additional strands added allow for the spring constant to increase. This will allow for a greater energy storage inside the web.

Material Selection

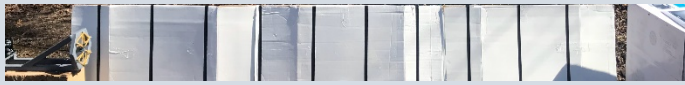
The web geometry was an important part of the spider's ability to achieve such a high acceleration. Following this, the next step is to find a suitable material. Latex rubber tubing was chosen due to its high elasticity and tensile strength.

Cad Drawing



Testing

The testing was done using a white background with black lines marked out at every foot. This allowed for the distance covered by the ball to be known and analyzed. A video of the launch was taken with a galaxy note 10 phone. This captures video at 1000 frames per second. Two separate web designs were tested.



Data Analysis

The data was analyzed first using the tracker software. This software analyzes the video and was able to obtain the velocity of each projectile. After this was complete calculations were preformed to find the acceleration, potential energy, and energy density. The table below compares the slingshot spider's data to the maximum values achieved from each of the web designs.

	Displacement (m)	Velocity (m/s)	Acceleration (m/s^2)	Acceleration (gs)	PE (J)	E (KJ/Kg)
Web Design 1	0.3556	77.01	8340	850	16.33	0.72
Web Design 2	0.4318	66.41	5107	521	23.85	0.60
Sling Shot Spider	0.0268	4.16	1163	130	-	3.92