UTA016: Re-Designing Of The Throwing Arm

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Working of mangonal

The mangonel works by pulling the arm from its 90° angle of equilibrium. By doing this, we store the potential energy of the catapult in the tension in the ropes. The arm makes an arc with radius equal to arm length. Therefore, the potential energy is transferred to rotational kinetic energy.

Observation

- Length of the throwing arm is 38 cm, and the diameter is 2.5 cm. Mass of ball is 50 grams .
- Material used in the throwing arm is sesame
- Shear stress and axel stress both are used in the functioning of the mangonal
- The variation of distance was observed with a change in torsion force

FACTORS AFFECTING RANGE

$$R = \frac{u^2 * \sin(2\theta) * (1 - e^{k*t/m})}{g * k}$$

- AIR DRAG (k depends on drag coefficient)
- INITIAL VELOCITY
- MASS OF PROJECTILE
- ANGLE

WHY WOODEN SPOON ?

- Better for NON-AERODYNAMIC and LIGHT-WEIGHT projectiles
- Safer and Simple for inexperienced hands

Challenges faced

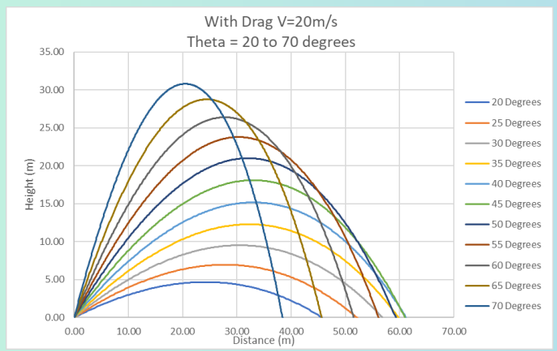
- We faced difficulty while tuning the throwing arm using the anchor block.
- The spoon made of wire deforms when it collides with the strike pad.
- The process of winding and tightening of ropes was very time consuming.
- Error found during measurement of angular velocity

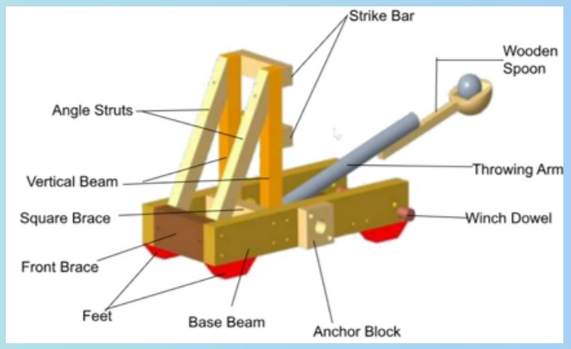
Formulas Used

DMF= Dynamic force/Static failure force
Euler's formula: Actual strength/distance from neutral axis= bending moment/second moment of area
FOS= failure stress/ allowable stress

Angular Velocity

5m: 0.79 rad/sec
10m: 0.63 rad/sec
15m: 0.62 rad/sec
20m: 0.61 rad/sec





Mangonal Parts

- Mangonel Kit has assembled properly
- Skein was spun in the mangonel which will hold the rod and will provide the force
- O ring was attached to the mangonel which will hold the rod and the trigger
- D ring was attached to the rod and fit in the skien