Final Lab

Thursday, May 4, 2023 12:37 PM

1) Derive the moment of inertia of the ring

$I = \frac{1}{2}MR^2$

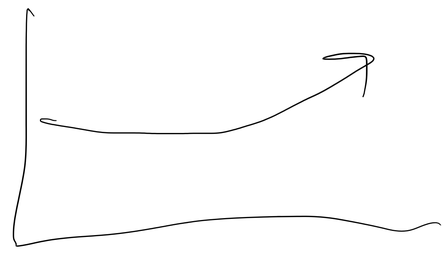
$\int r^2 \, dm = \frac{M}{\pi R^2} 2\pi r \, dr$

$I_{ring} = \frac{1}{2}m(R_1^2 + R_2^2)$

$I_{disk\ Diameter} = \frac{1}{4}MR^2$

We are going to measure the moment of inertia for a variety of objects and then measure them against our math derived values.

Software is going to plot Velocity vs. Time, then we will find acceleration.

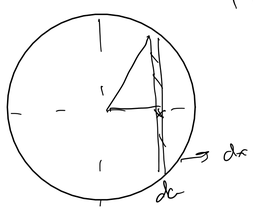


Derivations

$I_{disk} = \frac{1}{2}mr^2$

$I_{ring} = \frac{1}{2}(m)(R_1^2 + R_2^2)$

$(x, \sqrt{R^2 - x^2})$



$dm = \frac{M}{\pi r^2}$

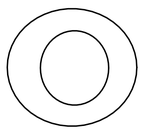
$da = h \cdot dx = 2 \cdot \sqrt{R^2 - x^2}\, dx$

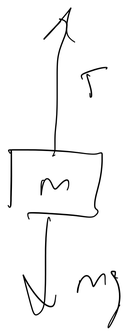
$da = \frac{M}{\pi R^2} \cdot 2 \cdot \sqrt{R^2 - x^2}\, dx$

r is changing because the string is overlapping on itself.

Use the biggest pulley.

the uncertainty is due to average minor one of the values





$mg - T = ma$

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$T \cdot R = I\alpha$

$T = I\alpha \cdot \frac{1}{R}$

$(mg - ma) = I \cdot \frac{a}{r^2}$

$\frac{r^2(mg - ma)}{a} = I$

Systematic Error

The dish is not a perfect disk, it has a groove and holes.

Error Prop

8-10 error props

- Three Geo Is
- For I of whole system
- Whole system error prop