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Flywheel Assignment Writeup

Further Science for Engineering (ACHA4007)

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1. Introduction

The aim of this experiment is to prove the theory of energy being stored in a flywheel. This theory is stated to be true online, such as an article by [Aquaswitch](#) (2023) which states that “Flywheels store rotational energy using the physical principle of conservation of angular momentum.” it was decided that the group would test it personally to prove that is true. To do this an experiment would be conducted to try and replicate the effects of a fly wheel.

2. Step by step Procedure

First a clear area was cleared to make space for the experiment to be carried out. After that we assembled the work panel and fitted the bearing block and flywheel to it, ensuring its placement by counting the holes in the work panel. After that a plastic guide and weight hanger were also fitted. The Lecturer present then cut the cord to ensure a 290mm vertical drop. Then, allowing the weight hanger to fall to the bottom of its travel a magnetic rule was moved behind it so its 0mm edge was aligned with the plastic guide. 90g of masses was then added to the weight hanger to give a total of 100g.

Once this was done the flywheel was slowly rotated until the bottom of the weight hanger was aligned with the 280mm mark on the rule. After this the experiment could start, it was carried out by dropping the weight and recording the time it took to fall from 280mm to 0mm and then return to its maximum height. It was done so using a stopwatch to record the time. This process was repeated three times, then 100g would be added and it would be repeated three times again. The pattern of testing three times to find an average and then adding 100g was repeated from the weights 100g to 500g.



Figure 1 - The Assembly of the flywheel



Figure 2 - Weights used

3. Results (Raw Data)

Table 1 - Raw Data

Mass (Kg)	Time (s)	Height (m)
0.1	4.34	236
0.1	4.21	237
0.1	3.93	237
0.2	3.02	251
0.2	2.72	250
0.2	2.47	251
0.3	2.34	251
0.3	2.48	253
0.3	2.57	254
0.4	2.29	250
0.4	2.01	251
0.4	2.2	249
0.5	2.01	240
0.5	1.86	245
0.5	2.11	235

4. Analysis of data

Table 2 - Calculated Data

Mass	Initial PE	Tt	h2	mg	PE loss adjusted	Tf	Acceleration	v	ω	Torque	α	KE
kg	J	s	m	N	J	s	m/s ²	m/s	Rads/s	Nm	Rad/s ²	J
0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0
0.1	0.27468	4.16	0.237	0.981	0.022845725	2.252998	0.110323083	0.248557692	38.2778	0.006305	16.97278	0.297526
0.2	0.54936	2.9	0.251	1.962	0.030002712	1.52919	0.239477663	0.366206897	56.39573	0.012442	36.84272	0.579363
0.3	0.82404	2.46	0.253	2.943	0.041743114	1.292308	0.33531746	0.433333333	66.73318	0.018476	51.5873	0.865783
0.4	1.09872	2.15	0.25	3.924	0.062191698	1.135849	0.434057019	0.493023256	75.9254	0.024377	66.778	1.160912
0.5	1.3734	1.99	0.24	4.905	0.105646154	1.071538	0.487722172	0.522613065	80.48222	0.030297	75.03418	1.479046
h1 (m)	0.28											
g (m/s ²)	9.81											
c (m)	0.0408											
r (m)	0.0065											
I (kgm ²)	0.0005											

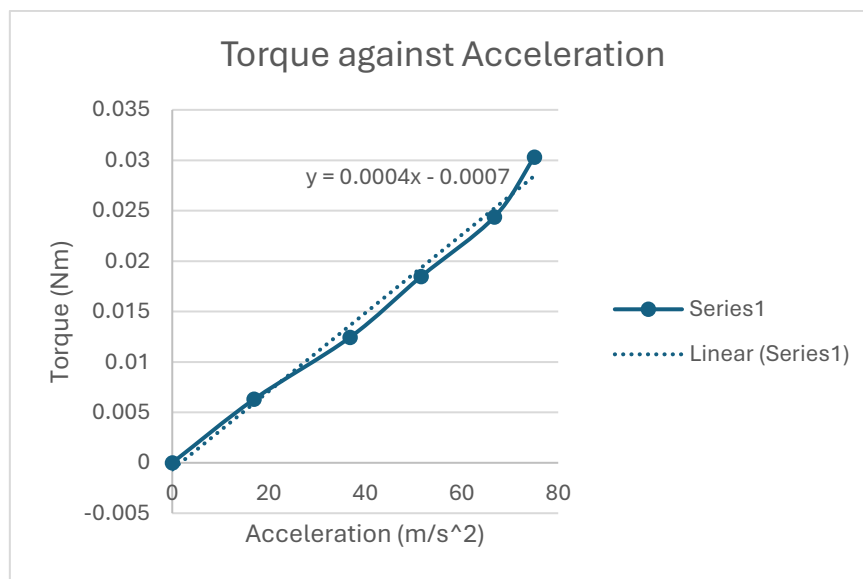


Figure 3 - Graph of Torque against Acceleration

Using the data collected an Excel document was then made to calculate the remaining forces and values. This was done using a variety of equations, firstly to find out the Initial Potential Energy. This was done by multiplying mass by gravity and h1. Next was mg which was solved by simply multiplying the mass by gravity. The other columns were solved in a similar fashion. After all the values were calculated, a graph was created to visually display the torque against acceleration. Using these results, it can be proved that flywheels store kinetic energy by comparing the values of the mass and KE. It can also be seen that acceleration increases with the weight also.

5. Conclusion of experiment

From this experiment it can be concluded that the theory of flywheels storing kinetic energy is true, this was found by analysing the results produced from the table made in excel. In the process the relation between other values were discovered such as acceleration, angular velocity and others.

6. Evaluation

To improve accuracy, checks of the equipment to ensure their functionality would have been ideal. Testing the stopwatch would have eliminated any doubts about accuracy as would have testing the weights to make sure they were as accurate as possible. Another improvement to accuracy that could have been made is the quantity of people recording the time, with two people recording the time the room for human error is slimmed by averaging the two resulting values.

7. Further work

In ideal circumstances where money and time are of no issue, to ensure that the experiment is fair and accurate robots would be the best course of action due to their mechanical precision. For example they would be able to drop the weight from the exact same height each time, or for recording the time their reaction times would be multitudes more accurate than a humans. Another addition that could be made is a high speed camera so the time could be recorded more accurately.

Bibliography

AquaSwitch Christian.M (2023) [Flywheel Energy Storage | Efficient Power Solutions](#)