Physics Report

Uncertainty in Atwood's machine

Alejandro Serruto Servat

Alejandro Serruto Servat

Lab Report: Physics

Question

How does acceleration of the system vary according to the difference in between masses?

Procedure

1. Set up a pulley system using a wheel
2. Place four 50g blocks in each side of the rope that rests in the pulley.
3. Pull one of the weights down and release it without pushing it or pulling it and record the acceleration using the sensor and logger pro.
4. Measure the acceleration by measuring the slope of the graphic.
5. Record your data
6. Repeat each step but taking 50 grams off from one of the sides of the pulley and placing it in the other side, unbalancing the weight.

Variables

- Independent: The mass in each side of the pulley (g)
- Dependent: The acceleration of the motion (ms-2). The difference of mass on each side of the pulley
- Control: The total mass in the system.

Data

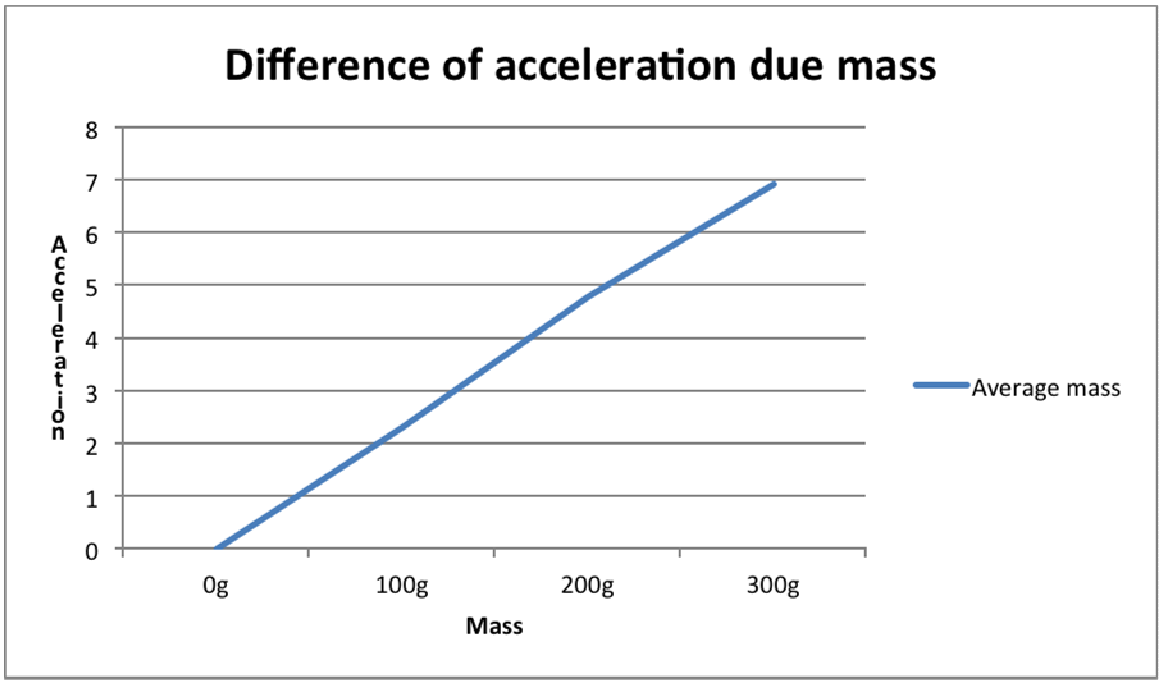
M_1(g)	M_2(g)	Mt (g)	Difference (g)	a_1(ms-2)	a_2(ms-2)	a_3(ms-2)	a(ms-2)
250g	150g	400g	100g	2.39	2.20	2.38	2.32
300g	100g	400g	200g	4.78	4.80	4.84	4.8
350g	50g	400g	300g	6.92	7.04	6.86	6.94

Table Analysis

When the mass of the system was unbalanced, I figured out that the more unbalanced the mass on both sides of the pulley then the motion will have a greater acceleration. This is

due to the larger weight force that the side of the system with more mass has; this produces a bigger force in the direction of the side with a larger weight force.

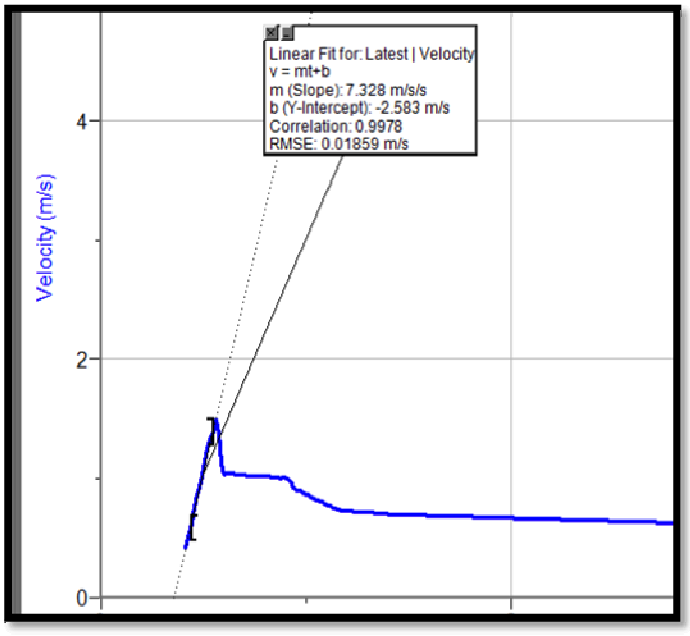
This can be explained with the Acceleration formula in Dynamic Systems: **(Wb-Wa)/(Ma+Mb)**



Graphic

Graph Analysis

The previous graph displays how the acceleration increases. Apparently the acceleration is constantly increasing with every 100 grams of difference in the pulley system.



The following graph recorded from logger pro shows how the speed of the motion is constantly increasing and therefore there is a constant acceleration.

Now what follows is the participation of the weight force.

The acceleration is dependent on two things, the difference of the mass, and therefore the difference

of the weight force. This is expressed in the formula

(Wb-Wa)/(Ma+Mb)=a

In order to justify the use of this formula we need to first find the weight force. I'll use an example to justify this with 100 grams of difference between the two sides of the pulley.

Wa=Ma x g → Wa= 150 x 9.81 →Wa=1471.5 newtons

Wb=Mb x g→ Wb= 250 x 9.81 →Wb=2452.5 newtons

A= (Wb-Wa)/(Ma+Mb) → 2452.5 – 1471.5/250 + 150 = 2.45 ms-2

The result is almost the one that I got as the final average. This shows that the weight force and the mass are directly proportional and so affecting proportionally the acceleration of the system.

Now that we got that result, what would happen if taken in consideration? The measuring limit would be in this case 0.5 grams. If this was applied then the accelerations would be

Weight difference	Acceleration with Original Weight	Acceleration with +0.5 grams of weight	Acceleration with -0.5 grams of weight
100	2.45ms^-2	2.44ms^-2	2.45ms^-2
200	4.9 ms^-2	4.89ms^-2	4.89ms^-2
300	7.35 ms^-2	7.32ms^-2	7.37ms^-2