**CONSERVATION OF ANGULAR MOMENTUM**

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PHY 133

SECTION 05

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DATA TAKEN: 04/14/2014

LAB DUE: 04/17/2014 at 12:00 PM

LAB HANDED: 04/17/2014

**INTRODUCTION:**

The collision of a spinning disk with a disk that is not spinning helps one to analyze motion in two dimensions and how the angular momentum is conserved in a system. The importance of this topic is to realize that total momentum of objects in any kind of constant in ideal conditions, the momentum is simply transferred from one object to the other object involved in the collision.

**EXPERIMENTAL SETUP:**

The materials that were used in this experiment was a rotating platform (heavy steel annulus on lighter disk with axle into bearing) with photogate, pulley, and cylinder for winding string around), heavy steel disk with aluminum handle (with label showing measured mass), mass with attached string to be wound around cylinder below the rotating table, pulley (changes direction of string tension so mass can accelerate vertically under gravity to “spin up” rotating table), interface box, vernier caliper (to measure the diameter of the cylinder), meter stick (to measure objects too big for the caliper), the software Logger Pro to collect the data by the photogates. Using the photogates we can calculate the angular velocity of the disk.

**(5)** The slope of this line should be positive this time as the slope gives us acceleration and the disk is now experiencing positive acceleration. In the earlier graph the disk was being retarded by the friction force but this time it is being accelerated by the force of the attached mass.

**(6)** For R, you first measure the Diameter of the handle and then you use a ruler to calculate the distance from the handle to the end and add it up. Since for both measurements, the error is 0.5mm, when adding them you add the uncertainty and hence the uncertainty becomes 1mm.

**(10)** If the center of the dropped disk does not coincide with the axis of rotation of the rotating platform then it could possibly make a difference to the measurement of final momentum. This is because it will change the value of the Moment of inertia of the final momentum and hence increase the value of the final momentum.

**(7)**

I­­disk =

**(8)**

**DATA TAKEN:**

The goal of this lab is to verify the law of conservation of angular momentum. In order to verify this, we need to calculate the angular momentum of the disks before and after the collisions. We use a digital scale to measure the mass of the disks. Then we let the disk rotate freely and record the data to calculate the force of friction. We then hang a mass from the disk and let the force of the mass rotate the disk use the recorded data to calculate the moment of inertia of the disk. We spin the disk and let the second disk fall on top of it and collect the data both before and after the fall. Using the data we can check if the momentum was conserved or no.

**(2)** We assumed the absolute value of r for the radius is r to be equal to 0.25mm. This is because the vernier calipers we used to measure the diameter of the disk give us an error of 0.5 mm and then when we calculate the radius by dividing by 2. Hence the error in radius is 0.25

**DATA ANALYSIS:**

We use the data we collected using the logger pro software to calculate the acceleration and using the data for the rotation with attached mass, we can calculate the Moment of Inertia. Using this data we are able to calculate the Angular Momentum of the disks both before and after the fall. By analyzing this data we can prove that the momentum is conserved in each collision.

1. The ω⃗ vector is the vector of the angular velocity and its direction is constantly changing and is always perpendicular to the radius vector. The α⃗ is the vector of the angular acceleration and is always parallel to the vector of the string to which the mass is attached to. In every revolution, the angular velocity vector points In the same direction as the acceleration for exactly 1 point.
2. The computational tool gives the range of the slope to be a ϵ [0.101305, 0.105095] and the graphical analysis gives a ϵ [0.1037,0.1209]. Both these values are consistent with each other.
3. The slope of this line should be positive this time as the slope gives us acceleration and the disk is now experiencing positive acceleration. In the earlier graph the disk was being retarded by the friction force but this time it is being accelerated by the force of the attached mass.

**RESULTS AND DISCUSSIONS:**

Through the analysis of the data we calculated the angular momentum before the collision falls within range of the momentum after the fall.

**(9)** The range for the initial momentum is L ϵ [0.6898, 0.7422] and the range for the final momentum is L ϵ [0.641, 0.675]. These values are not exactly consistent with each other however they are very close. This is because we possibly lost momentum if the disk didn’t fall exactly at the center of the axis of rotation. Another possible source of loss is the loss of energy in the form of sound when the falling disk impacts with the rotating platform.

**CONCLUSION:**

The goal of this lab was to verify the law of conservation of momentum. Through various calculations and the analysis of the data, one is able to prove this.

  
 