Rotational Motion

1 Assignment

At your lab station, you should have three shapes: a circle, a pentagon, and an L. The moment of inertia about the center of mass of the L shape is known to be $I_{L,cm} = (9.7 \pm 0.7) \times 10^{-4}\ kg \cdot m^2$. You also have a mass set at your station. The moment of inertia about the center of mass of the 20 g mass is $(1.32 \pm 0.05) \times 10^{-6}\ kg \cdot m^2$.

Based on this information, your team is tasked with two assignments:

1. confirming that angular momentum is conserved. By rotating the L shape and carefully dropping the 20 g mass onto the L shape, the angular momentum *before* the drop can be compared to the angular momentum *after* the drop.
2. finding the moments of inertia about an axis of rotation for the circular shape and the pentagonal shape.

2 Deliverables

For your lab report, 10% of the grade will be for following the guidelines in the lab report template. Another 10% will be allocated for the Abstract and Introduction of your report. The remaining percentage will be based on your inclusion of:

1. *[10%]* a general description of the procedure that can be used to identify the position of the center of mass of an object, such as these flat shapes.

- for assignment 1:

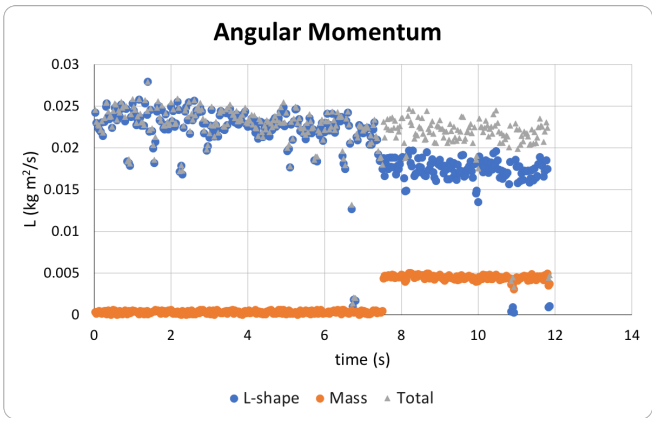
2. *[15%]* a description of the procedure you used to determine the angular velocities of the objects from the camera data, and a description of procedure you used to compute the angular momentum of the shapes and mass, including all necessary equations.
3. *[15%]* a plot showing the angular momentum of the L shape and 20 g mass, and total as a function of time. This plot should include data before *and* after dropping the mass on the rotating shape. See the example plot in the next section.
4. *[15%]* a discussion on whether the angular momentum was conserved during the dropping of the mass or not based on the plot above.

- for assignment 2:

5. *[15%]* a description of the procedure you used to determine the two unknown moments of inertia of the circle and pentagon shapes around their respective axes of rotation. Make sure to include relevant equations.
6. *[10%]* for both the circle and the pentagon shape, report the value of the moment of inertia about the axis of rotation along with the uncertainty of the measurement.

3 Results Reporting

The values in the plots below are completely made up and may make no physical sense. These plots are here only to exemplify the type of plots and format that is requested in the report.


Angular Momentum
0.03
0.025
0.02
0.015
0.01
0.005
0
L (kg m²/s)
0
2
4
6
8
10
12
14
time (s)
L-shape
Mass
Total