LAB EXERCISE
PARALLEL AXIS THEOREM

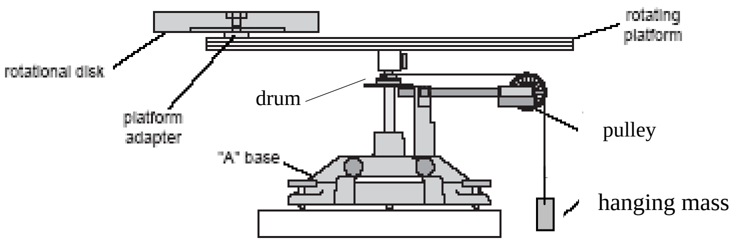
I. THEORY

The purpose of this experiment is to verify the parallel axis theorem.

For additional theory see Experiment #9.

II. LABORATORY PROCEDURE

1. Obtain the disk you used in Experiment #9. Record its mass and diameter. Record the experimental moment of inertia you determined in Experiment #9 for this disk when horizontal with an axis through its center of mass.
2. Attach the rotating platform to the axle. Attach the platform adapter to the platform. Center the adapter 5.0 cm from the axis of rotation. Place the disk on the adapter, bearing side up (the side with the indentation for the ring should be down).
3. Level the apparatus by following these step: (1) Adjust the leveling screw on one of the legs of the base until the end of the side of the platform with the disk is over the leveling screw on the other leg of the base. (2) Rotate the platform 90 degrees so it is parallel to one side of the "A" and adjust the other leveling screw until the platform will stay in this position. The platform should now be level and should remain at rest in any position. **If you move the apparatus after leveling, you will need to repeat this step.**
4. If the pulley is not already attached, mount it to the base. Pass the thread over the pulley, making sure that the string passes along a straight line over the center of the pulley without rubbing against any object.
5. Determine the friction mass for the system to the nearest gram. If the friction mass exceeds 10 grams, check with the instructor.
6. Remove the friction mass and attach a 100 gram driving mass. Wind up the string on the drum and raise the driving mass to a convenient height as measured by a two-meter stick with a caliper jaw. Record the height, measured to the nearest 0.1 cm. Release the mass and start the stopwatch. Stop the watch when the mass strikes the floor. Record the time.
7. Using the same height, carry out two more runs as in step 6.
8. Remove the disk. Move the platform adapter so it is centered 10.0 cm from the axis of rotation. Replace the disk and repeat steps 3-7.
9. Repeat step 8, centering the platform adapter 12.0 cm and 15.0 cm from the axis of rotation.
10. Center the platform adapter at 0.0 cm (at the axis of rotation). Do not include the disk. Repeat steps 3-7, but use a 50 g driving mass.
11. Measure the mass of the platform adapter. Measure the diameter of the drum.



Set-up for Disk Off-Axis

III. CALCULATIONS AND ANALYSIS

Report all of your calculations in SI units. Use scientific notation when appropriate.

Perform calculations 1-4 for each location of the platform adapter with the disk attached.

1. Assuming the acceleration of the driving mass was constant, calculate the speed and the translational kinetic energy of the driving mass right before it strikes the floor. Use the average of the three measured times.
2. Using the work energy theorem, calculate the rotational kinetic energy of the system right before the driving mass strikes the floor.
3. Calculate the angular velocity of the system right before the driving mass strikes the floor.
4. Using the rotational kinetic energy and the angular velocity of the system, calculate the experimental moment of inertia of the system.
5. Make a graph of experimental moment of inertia of the system vs. square of the distance of the platform adapter from the axis of rotation.
6. Why should the graph be a straight line? Explain.
7. Draw a best-fit line and determine the slope and intercept of the line.
8. What physical quantity should the slope equal? What physical quantity should the intercept equal? Explain your answers.
9. Repeat steps 1-4 for the case with just the platform adapter located at 0.0 cm.
10. Using data from this lab exercise, determine experimental values for the two physical quantities discussed in step 8, if possible. Calculate the percent difference between each experimental value and the value obtained from the graph.
11. Can you determine an experimental value for the moment of inertia of the horizontal disk about an axis through its center of mass based on data from this lab exercise? Explain. If possible, calculate this value and compare it the value you obtained in Experiment #9. Also compare to the theoretical value.