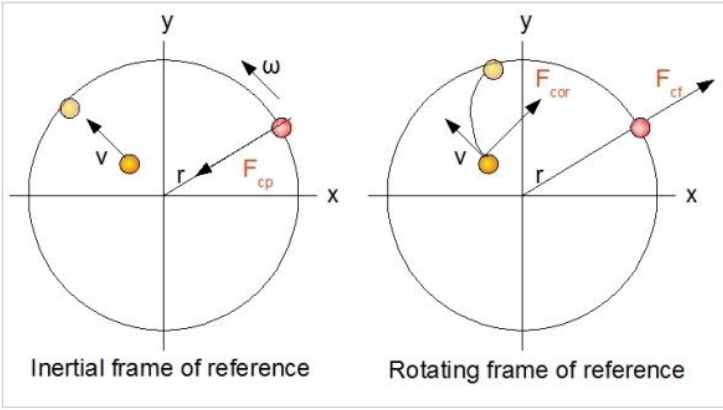
Manual to Lab 4: PHY2048C

Florida State University

Rotating Frames



About labs in this class

The labs in this class will have general instructions, and many things need to be figured out by the students. **Answer the questions and record your measurements in your lab notebook and then submit the notebook at the end of the activity.**

About this lab

In this lab, you will measure the elastic constant of a spring by considering a rotating frame and a centrifugal force. You will also estimate the torque of an electric motor.

Activity 1. Turn on the device. Draw a diagram explaining its workings. Get the spring to expand.

Activity 2. Draw a free body diagram of the mass-spring system on an inertial frame. Assume only the elastic force acts on it.

Activity 3. Draw a free body diagram of the mass-spring system on a rotating frame centered at the spring's center of mass.

Question 1: What other forces arise when considering a rotating frame?

Activity 4: Determine the elastic constant k.

Activity 5: Compare your value with the other three groups and make a histogram of the four values. Use the standard deviation as the error in your measurement.

Question 2: Estimate the torque that the electric motor exerts on the belt. Assume the whole device is made of iron ($\rho = 7.87 \frac{g}{cm^3}$) and that the belt is massless. (Hint: $\tau \approx \frac{\Delta L}{\Delta t}$)