

Homework #5

Dr. Ramy Gohary

1. Consider the system shown in Figure 1. For this system
 - (a) use the energy conservation second law to derive a mathematical model for system dynamics and compare with you results in the previous homework;
 - (b) use Laplace transform to obtain an explicit time response of the system; and
 - (c) derive an expression for the natural frequency.
2. Use the law of conservation of energy to obtain a mathematical model for the second order rotational system shown in Figure 2. Assume that the mass is originally turned with an angle $\theta = 0.1\pi$ and then released. .
3. Consider the system shown in Figure 3. In this system, assume that the surface is rough and that the cylinder has a radius R and mass M .
 - (a) Derive an expression for the moment of inertia of the pulley.
 - (b) Use the law of conservation of energy to derive a mathematical model for the system.
 - (c) Use Laplace transform to obtain an explicit expression for the displacement $x(t)$.

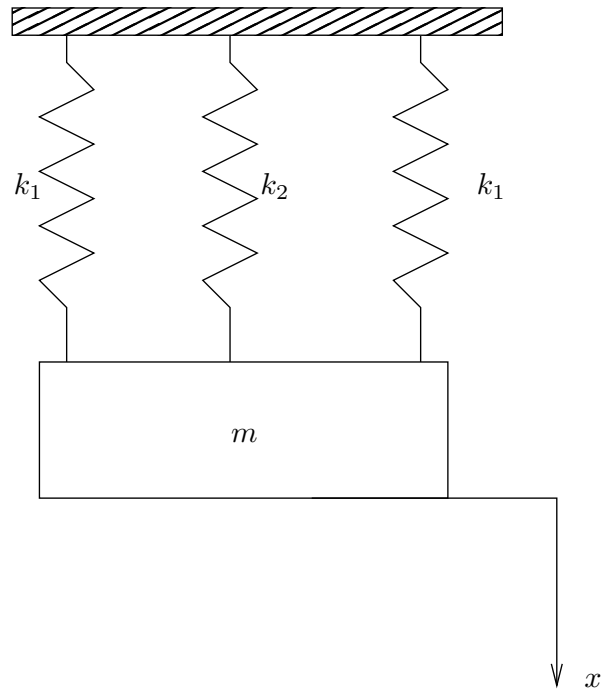


Figure 1: Hollow Cylinder

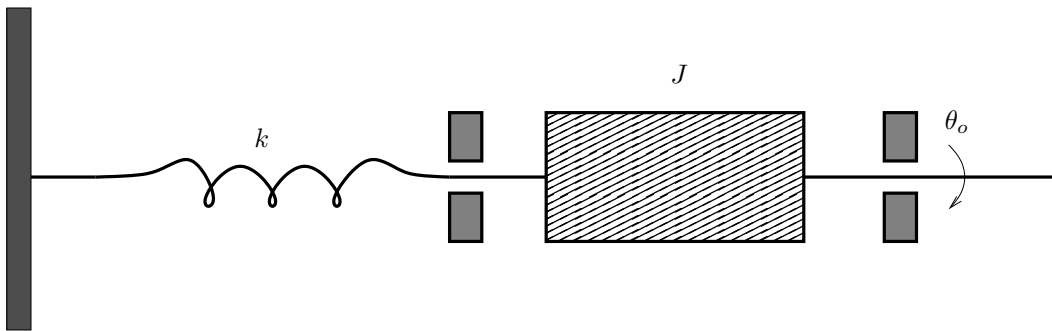


Figure 2: Second order rotational system without damper.

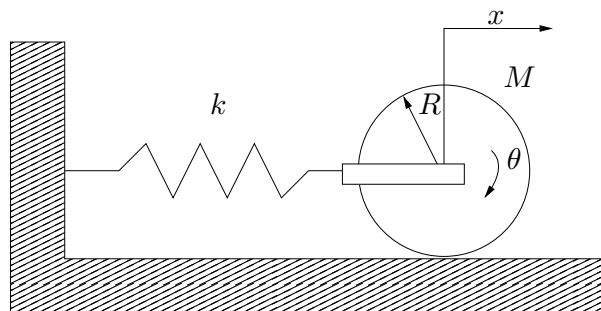


Figure 3: Rolling cylinder