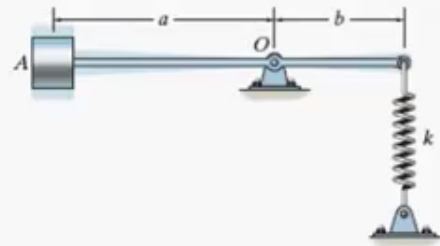


Problem 13.1

Natural Period of a System

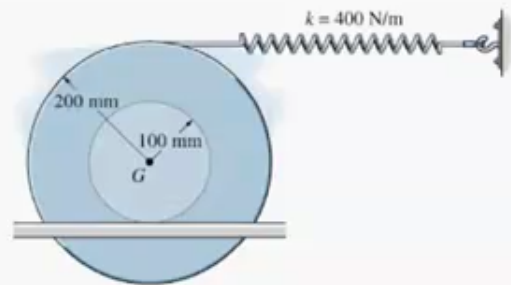
The block has a mass m and is supported by a rigid bar of negligible mass. If the spring has a stiffness k , determine the natural period of vibration for the block.



Problem 13.2

Vibrations with Energy Methods

Determine the differential equation of motion of the 3 kg spool. Assume that it does not slip at the surface of contact as it vibrates. The radius of gyration of the spool about its center of mass is $k_G = 125$ mm.



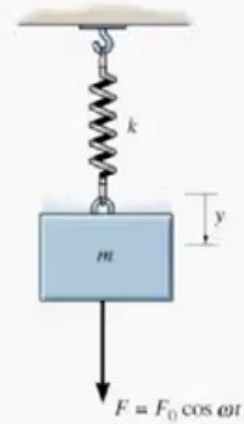
Problem 13.3

Undamped Forced Vibration

If the block is subjected to the impressed force $F = F_0 \cos \omega_0 t$, show that the differential equation of motion is:

$$\ddot{y} + (k/m)y = (F_0/m) \cos \omega_0 t$$

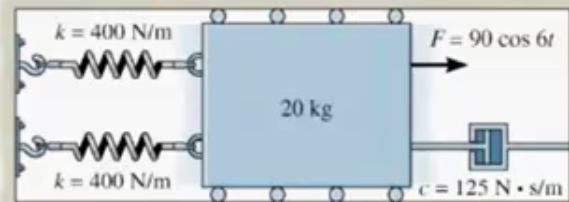
where y is measured from the equilibrium position of the block. What is the general solution of this equation?



Problem 13.4

Damped Forced Vibration

The 20 kg block is subjected to the action of the harmonic force $F = 90 \cos 6t$, where t is in seconds. Write the equation which describes the steady-state motion.



Problem 13.5

Electrical System Vibration Analogy

Draw the electrical circuit that is equivalent to the mechanical system shown. What is the differential equation which describes the charge q in that circuit?

