

Homework #2

Due: Friday, September 13

1) A mass m is initially at rest, partially supported by a spring and partially by stops (see Figure 1). In the position shown, the spring force is $mg/2$. At time $t = 0$ the stops are rotated, suddenly releasing the mass. Determine the motion of the mass.

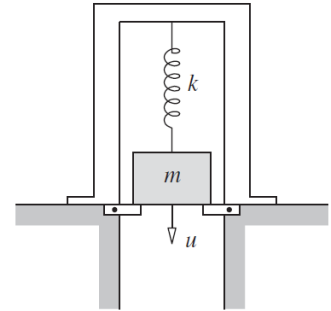


Figure 1

2) The weight of the wooden block shown in Fig. 2 is 20 lb and the spring stiffness is 120 lb/in. The block is initially at rest. A bullet weighing 0.4 lb is fired at a speed of 50 ft/sec into the block and becomes embedded in the block. Determine the resulting motion $u(t)$ of the block.

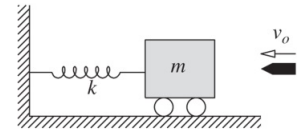


Figure 2

*Hint: Use conservation of momentum.

3) The vertical suspension system of an automobile is idealized as a viscously damped SDF system. Under the 3000-lb weight of the car the suspension system deflects 2.1 inches. The suspension is designed to have a damping ratio of $\zeta = 0.7$ with no one in the car.

- (a) Calculate the damping and stiffness coefficients of the suspension.
- (b) With four 150-lb passengers in the car, what is the effective damping ratio?
- (c) Calculate the natural vibration frequency for case (b).

4) Find a linear elastic oscillator, measure its damped natural frequency and determine its percentage of critical damping. Submit a sketch of the system, your measurements, and calculations.

Hint: It is up to you how you measure the response. One option is that your cell phone can be used as an accelerometer.