Answer on Question #47775, Physics, Other

In an experiment to determine the period of oscillation of a loaded spiral spring, the equation of a simple harmonic oscillator

$$a=(-k/m)\times x,$$

where the symbols have their usual meaning, was used. Write down the equation for the angular frequency ω in terms of k and m, the effective mass of the system.

Solution:

Displacement of a spring can be given by

$$x = A * Cos(\omega t)$$

where A is the Amplitude of motion and ω is the angular frequency

Now Differenting once will give velocity;

$$v = -A\omega Sin(\omega t)$$

and again to give acceleration

$$a = -A\omega^2 Cos(\omega t)$$

Now substituting our formula for Acceleration and displacement into our equation of motion

$$a + \frac{k}{m}x = 0$$

Gives

$$-A\omega^2 Cos(\omega t) + \frac{k}{m}ACos(\omega t) = 0$$

Which can be rearranged to

$$A(-\omega^2 + \frac{k}{m})Cos(\omega t) = 0$$

Can get rid of the A and Cos(ωt) which leaves

$$-\omega^2 + \frac{k}{m} = 0$$

which can be rearranged to

$$\omega = \sqrt{\frac{k}{m}}$$

Answer: $\omega = \sqrt{\frac{k}{m}}$