Matthew Kalachev Opemipo Odugbemi Cristofer Martinez Alseny Diallo

1) a)

- A Trampolin :

Elastic potential energy relates primarily to springs, but springs are a major part of everyday life. They can be found in everything from the shock-absorber assembly of a motor vehicle to the supports of a trampoline fabric, and in both cases, springs blunt the force of impact.

If one were to jump on a piece of trampoline fabric stretched across an ordinary table—one with no springs—the experience would not be much fun, because there would be little bounce. On the other hand, the elastic potential energy of the trampoline's springs ensures that anyone of normal weight who jumps on the trampoline is liable to bounce some distance into the air. As a person's body comes down onto the trampoline fabric, this stretches the fabric (itself highly elastic) and, hence, the springs. Pulled from a position of equilibrium, the springs acquire elastic potential energy, and this energy makes possible the upward bounce.

- The spring-mass system can usually be used to find the period of any object performing the simple harmonic motion.It governs the motion of a mass-spring oscillator.

B. Equations used

$x'' + \omega^2 x = 0$

The general solution is;

$x(t) = c_1 \cos \omega t + c_2 \sin \omega t$

This gives the position of the mass at any point in time. Simple Harmonic motion is the motion of the mass.

$T = \frac{2\pi}{\omega}$

This is the period of the motion.

$f = \frac{1}{T} = \frac{\omega}{2\pi}$

Here is the calculation for the frequency.

Damped Vibration

$mx'' + bx' + kx = 0$

Associated Characteristic is;

$mr^2 + br + k = 0$

Considering three cases based on whether the characteristic equation has distinct real roots, a repeated real root, or complex conjugate roots.

$x = \frac{-b \pm \sqrt{b^2 - 4mk}}{2m}$

Forced Vibration is;

$mx'' + bx' + Kx = f(t)$

The external force is represented by the f(t) term just as we have seen in Non-Homogeneous Linear Equations. Our “y” which is the general solution will be;

$x(t) = c_1 x_1(t) + c_2 x_2(t) + x_p(t)$ 😜

$x_p(t)$ is a particular solution to the non-homogeneous equation, Which can be solved using variation of parameters.

2.

Links; I.

https://openlab.citytech.cuny.edu/https-openlabcitytechcunyedu-poiriermat2680fall2022/2022/11/14/spring-problems-1/

II.

https://www.numerade.com/ask/question/mat-2680-question-5-extra-credit-october-spring-2018-stretches-25-and-then-an-extra-points-released-feet-16-ib-object-is-suspended-the-the-mass-is-with-the-weight-attached-from-the-spring-th-71969/

III.

https://digitalcommons.trinity.edu/cgi/viewcontent.cgi?article=1007&context=mono page 268