Simple Harmonic Motion And its Applications on free fall Motion

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ABSTRACT

In this paper include pendulum and spring-mass with linearly increasing length and mass respectively are used as proof for this observation. It is shown in this paper how Bessel function can be approximated by the damped sinusoidal function. The numerical methodology that's introduced works okay in adiabatic condition (slow change) or in small time (independent variable) interval.

KEYWORDS: - Acceleration, Amplitude, Angular frequency, Harmonic, Oscillations.

INTRODUCTION

In mechanics and physics, straightforward motion is additionally a special type of motion or oscillation motion wherever the restoring force is directly proportional to the displacement and acts in. Simple periodic motion will function a mathematical model for a spread of motions, like the oscillation of a spring. In addition, alternative phenomena are often approximated by straightforward periodic motion, together with the motion of an easy apparatus in addition as molecular vibration. Simple periodic motion is typified by the motion of a mass on a spring once it's subject to the linear elastic restoring force given by Hooke's Law. The motion is curving in time and demonstrates one resonant frequency. For simple periodic motion to be associate degree correct model for a apparatus, cyberspace force on the thing at the tip of the apparatus should be proportional to the displacement. This is a decent approximation once the angle of the swing is tiny. The motion of a particle moving on a line with associate degree acceleration whose direction is often towards a hard and fast purpose on the road and whose magnitude is proportional.to the gap from the fastened purpose is termed straightforward periodic motion [SHM]Simple periodic motion shown each in real house and space. The orbit is periodic. (Here the velocity and position axes have been reversed from the standard convention to align the two diagrams) In the diagram, a simple harmonic oscillator, consisting of a weight attached to one end of a spring, is shown. The other finish of the spring is connected to a rigid support like a wall. If the system is left at rest at the equilibrium position then there's no web force working on the mass. However, if the mass is displaced from the equilibrium position, the spring exerts a restoring elastic force that obeys Hooke's law.

Mathematically, the restoring force F is given by

$F = -k x$,

where F is that the restoring elastic force exerted by the spring (in SI units: N), k is that the spring constant ($N \cdot m^{-1}$), and x is that the displacement from the equilibrium position (m).

LITERATURE REVIEW

1) Describing Vibration:-

Vibration is outlined as "the circular amendment within the position of AN object as if moves alternately to at least one facet and also the And Order of some sentence. Vibration of rigid bodies can be rectilinear, rotational or a combination of the two.

Mathematically, Harmonic vibration of single degree of freedom system can be given by the expression.

$u(t) = u_o \sin wt$………… (1)

Where,

u (t) = the position of the point with respect to time t.
u (t) = maximum displacement of the point from datum line.
w = the circular frequency.
t = time
T=2π/w sec
f=w/2π cycle persewnd
Wave form of Simple Harmonic Motion
Describing the velocity and acceleration at the vibration point can be determined by tacking the first and second derivative of equation.

Velocity

$$\frac{du}{dt} = u_0 w \cos wt$$

Acceleration

$$\frac{d^2u}{dt} = u_0 w^2 \sin wt$$

From studding this equation one can see that the displacement value u (t) and the acceleration value are at a maximum when the velocity is equal to zero.

Reference example:

Problem: An object does free fall motion. Its hits the ground after 4 seconds. Calculate the velocity of the object after 3 seconds and before it hits the ground. What can be the height it is thrown?

Solution: Velocity after 3 seconds is:

V=g.t

V= 10m/s^2.6s

Velocity after 4 seconds is:

V=g.t

V=10m/s^2.6s

V= -40m/s

Height is:

h=1/2 g.t^2

h=1/2 10m/s^2.4x4=80m.

The example given above try to show how to use free fall equations. We can find the velocity distance and time from the given data. Now, we will give three more equations and finishes 1D Kinematics subject. The equations are:

$$V=V_0+at$$

$$X=V_0t+1-2.a.t^2$$

$$V_t^2=V_t^2+2.a.x.$$

IMPLEMENTATION SYSTEM

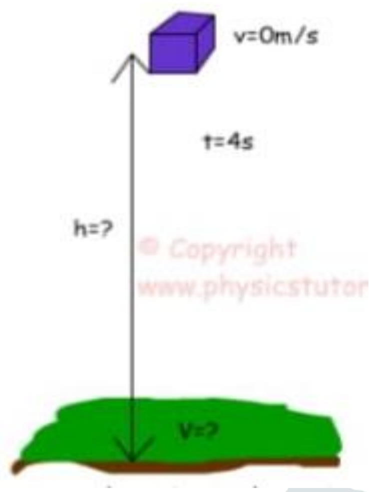

Fig.1: Body under free fall motion.

OBSERVATIONS

Advantages:

1)Displacement is a vector which points from the initial position of an object to its final position. The standard units of displacement are meters.
2) Velocity is a vector which shows the direction and rate of motion. The standard units of rate area unit meters per second.
Speed and rate aren't identical thing: speed could be a scalar, whereas rate could be a vector. One should use totally different rules once combining speeds and mixing velocities.
The average speed of AN object is that the total displacement throughout some extended amount of your time, divided by that amount of your time.
Instantaneous rate, on the other hand, describes the motion of a body at one particular moment in time.
3) Acceleration is a vector which shows the direction and magnitude of changes in velocity. Its normal units area unit meters per second per second, or meters per second square.
Average acceleration is that the total modification in rate (magnitude and direction) over some extended amount of your time, divided by the duration of that period.
Instantaneous acceleration is that the rate associated direction at that the rate of an object is dynamical at one explicit moment.
In everyday English, we have a tendency to use the term decelerate to explain the fastness of a body, however physicists use the word accelerate to denote each positive and negative changes in speed.

CONCLUSION

In this case study simple harmonic motion and its applications. Different applications problems are solved analytically with exact equation of simple harmonic motion. We can calculate the periodic time value of oscillating an object from origin by these methods. Aspiring is an elastic object that stores mechanical energy. Springs are typically made of spring steel. There are many spring designs. In everyday use, the term usually refers to coil springs. When a traditional spring, without stiffness variability features, is compressed or stretched from its resting position, it exerts an opposing force approximately proportional to its change in length (this approximation breaks down for larger deflections). The rate or spring constant of a spring is that the amendment within the force it exerts, divided by the amendment in deflection of the spring.

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