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Physics 194 - Lecture 12

Welcome!

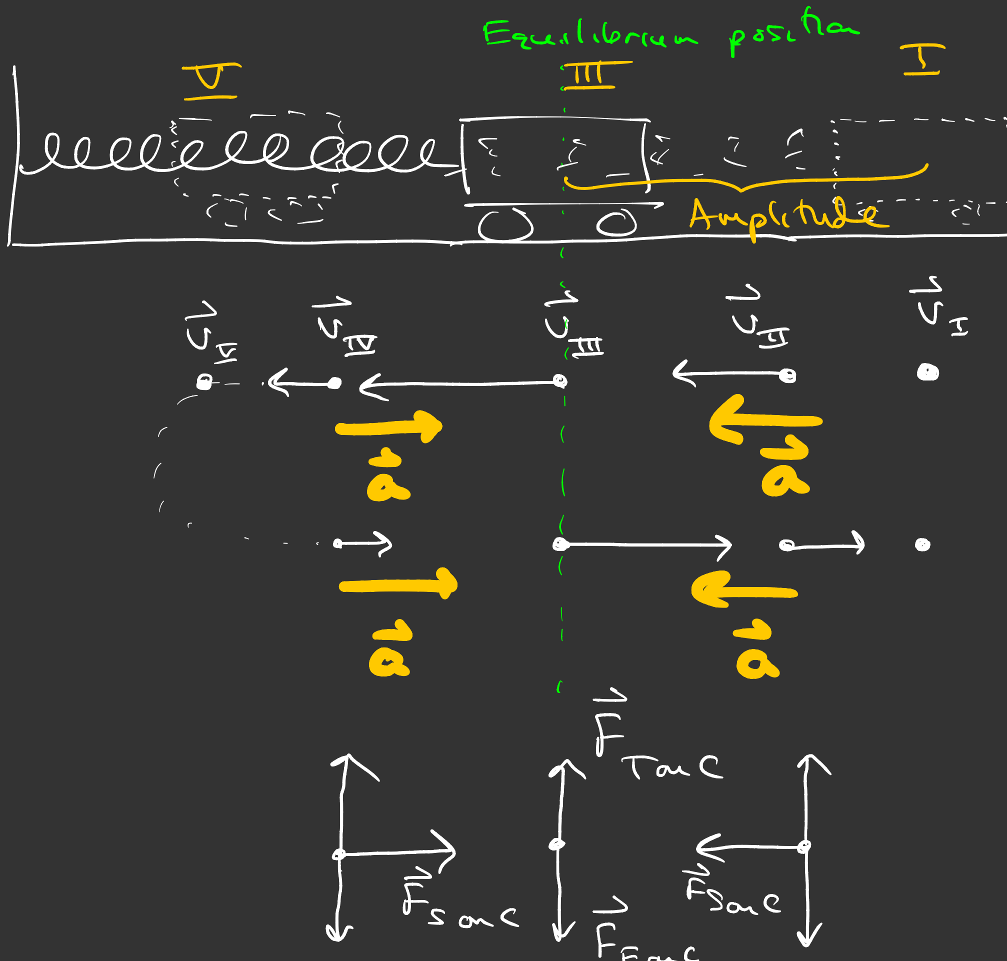
Have a question during class? Please ask it right away, even if it means interrupting in the middle of a thought. I want you to!

Agenda

- Vibrational motion
- Equilibrium position, restoring force
- Period, amplitude

Class starts @2:15 pm

Vibrational motion (type of periodic motion)



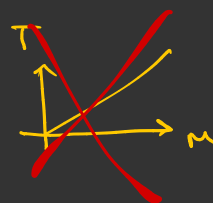
The period of motion is how much time one cycle of motion takes, T, in seconds.

Motion diagram

Force diagrams

The period, T, and amplitude, A, characterize the vibrational motion. But what does the period depend on? Mass of cart? Spring's constant? Amplitude?

- Cart mass: $M \uparrow \quad T \uparrow$
- Spring constant: $K \uparrow \quad T \downarrow$
- Amplitude: $A \uparrow \quad T \ldots$ No change!



Hooke's Law

$$F_{S\ on\ O} = K(\Delta x)$$

$F_{S\ on\ O}$ (N); K (N/m) spring constant; Δx (m) displacement from equilibrium

$$T = 2\pi\sqrt{\frac{M}{K}}$$

M (kg), K (N/m)

RHS: s^2

LHS: s

$$\frac{N}{m} = \frac{kg \cdot m/s^2}{m} = \frac{kg}{s^2}$$

$$U_s = \frac{1}{2}K(\Delta x)^2$$

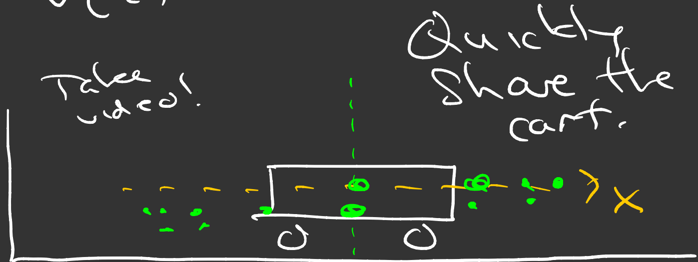
Elastic potential energy

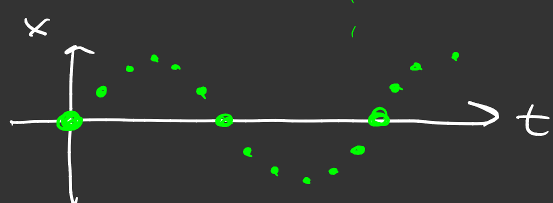
$$T = 2\pi\sqrt{\frac{m + \frac{1}{3}m_s}{K}}$$

What's the equivalent of kinematics for vibrational motion?

$x(t) =$

$v(t) =$





If an object has constant acceleration (vibrational motion doesn't)...

$$x(t) = x_0 + v_0 t + \frac{1}{2}at^2$$

$$v(t) = v_0 + at$$

$\vdots$

Vibrational motion needs 3 things

1) Equilibrium position
2) "Restoring force"
3) Add energy!