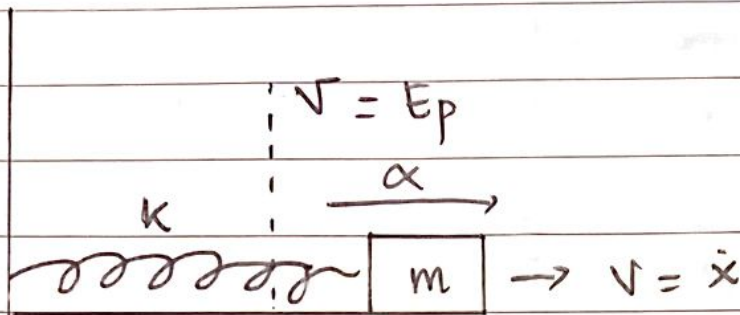


Gerak Harmonis Sederhana



a) Persamaan Lagrange

$$\bullet) V = \frac{1}{2} k x^2.$$

$$\bullet) T = \frac{1}{2} m \dot{x}^2.$$

$$\begin{aligned} \leadsto L &= T - V \\ &= \frac{1}{2} m \dot{x}^2 - \frac{1}{2} k x^2. \end{aligned}$$

$$\bullet) \frac{d}{dt} \left(\frac{\partial L}{\partial \dot{x}} \right) - \frac{\partial L}{\partial x} = 0$$

$$\begin{aligned} \bullet) \frac{\partial L}{\partial x} &= \frac{\partial}{\partial x} \left(-\frac{1}{2} k x^2 \right) \\ &= -2 \cdot \frac{1}{2} k x \\ &= -kx. \end{aligned}$$

$$\begin{aligned} \bullet) \frac{d}{dt} \left(\frac{\partial L}{\partial \dot{x}} \right) &= \frac{d}{dt} \left(\frac{\partial}{\partial \dot{x}} \left(\frac{1}{2} m \dot{x}^2 \right) \right) \\ &= \frac{d}{dt} \left(2 \cdot \frac{1}{2} m \dot{x} \right) \\ &= \frac{d}{dt} m \dot{x} = m \ddot{x} \end{aligned}$$

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$$\bullet) \frac{d}{dt} \left(\frac{\partial L}{\partial \dot{x}} \right) - \frac{\partial L}{\partial x} = 0.$$

$$m\ddot{x} - (-kx) = 0$$

$$m\ddot{x} + kx = 0. \quad 1 \text{ } m$$

$$\frac{m\ddot{x}}{m} + \frac{kx}{m} = 0$$

$$\ddot{x} + \frac{k}{m}x = 0.$$

$$\ddot{x} + \omega^2 x = 0$$

$$\bullet) \omega^2 = \frac{k}{m}$$

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

$$\bullet) \ddot{x} + \omega^2 x = 0$$

$$\boxed{\frac{d^2x}{dt^2} + \omega^2 x = 0}$$

$$x(t) = A \cos \omega t$$

Persamaan GHS.

$$1) x(t) = A \sin(\omega t)$$

$$2) v = \frac{dx}{dt}$$

$$= \omega A \cos \omega t$$

$$3) a = \frac{dv}{dt} = \frac{d^2x}{dt^2} = -\omega^2 A \sin \omega t$$

$$a = -\omega^2 x$$

$$\hookrightarrow \frac{d^2x}{dt^2} = -\omega^2 x$$

$$\frac{d^2x}{dt^2} = -\omega^2 x$$

$$\frac{d^2x}{dt^2} + \omega^2 x = 0$$