

IDENTIFYING SHM

For the following six (differential) equations, decide whether they describe a simple harmonic motion or not. If yes, find a formal expression for the oscillation period; if no, identify the mistake.

A $u(t) = u_0 \cdot \cos(\omega \cdot t^2)$

no SHM (extra 'squared' in t^2)

B $\xi(t) + k^2 \cdot \ddot{\xi}(t) = 0$

$$\ddot{\xi}(t) = -\frac{1}{k^2} \cdot \xi(t) \Rightarrow \text{SHM with } \omega = \frac{1}{k}$$

C $\dot{r}(t) = -\beta^2 \cdot r(t)$

no SHM (first derivative)

D $\psi(t) = C_1 \cdot \cos(\alpha \cdot t) - C_2 \cdot \sin(\alpha \cdot t)$

$$= C_3 \cdot \cos(\alpha \cdot t - \varphi_0) \Rightarrow \text{SHM}$$

E $\ddot{y}(t) = -\delta^2 \cdot y^2(t)$

no SHM (extra 'squared' in $y^2(t)$)

F $\frac{d^2 x}{dt^2} = B^2 \cdot x$

no SHM (minus sign missing before positive constant B^2)