Answer on Question #49389, Engineering, Other

Task:

A pendulum has max displacement of A=2.5m and frequency=6Hz. Displacement at time x is x=Asin(wt).where A is max displacement and w is angular velocity 2pief. Find time when displacement is 90cm.

Using a Power series expansion of above equation verify a time of 0.0416seconds for displacement to reach 250cm

Answer:

A=2.5m; f=6Hz; x_1=90cm;

t_2=0.0416; x_2=250cm

$x=Asin(wt)=Asin(2\pi ft)$

thus time when displacement is 90cm : $t_1 = \dfrac{1}{2\pi f}\arcsin\dfrac{x_1}{A} = \dfrac{1}{2\pi \cdot 6}\arcsin\dfrac{0.9}{2.5} \approx 0.00977s$

Using a Power series expansion of above equation: $\sin wt = wt - \dfrac{(wt)^3}{6} + O[t]^5$

$x_0 = A\sin wt_2 = A[wt_2 - \dfrac{(wt_2)^3}{6}] = A[2\pi ft_2 - \dfrac{(2\pi ft_2)^3}{6}] = 2.5[6.28*6*0.0416 - \dfrac{(6.28*6*0.0416)^3}{6}] =$

$= 1.643m$

So $x_0 \neq x_2$ and t_2 is incorrect.