

Damped oscillation

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Solution: *The oscillation is described by,*

$$x(t) = Ae^{-\gamma t} \cos \omega t ,$$

with $\omega = 2\pi/T$. Hence, the condition $x(0) = 2x(T)$ gives,

$$A = 2Ae^{-\gamma T} \quad \text{ou} \quad \gamma = \frac{\ln 2}{T} = 0.6931 \text{ s}^{-1} .$$

This gives the frequency of the undamped oscillation,

$$\omega_0 = \sqrt{\omega^2 - \gamma^2} = (2\pi) 0.9939 \text{ s}^{-1} ,$$

and the deviation,

$$\Delta T = T - T_0 = 2\pi \left(\frac{1}{\omega} - \frac{1}{\omega_0} \right) = 0.0061 \text{ s} .$$