TAIWO DAMILOLA

18/ENG05/058

Mechatronics.

F 12-3

$V = (4t - 3t^2)\ m/s$

Position $= S = \int v\,dt$

$S = \int 4t - 3t^2$

$= 2t^2 - t^3$

$S_{t=4} = 2(4)^2 - (4)^3$

$= -32m$

Distance = 32m to the left of the origin

F 12-4

$V = 0.5t^3 - 8t$

$a = \frac{\delta}{dt} v = 1.5t^2 - 8$

$a_{t=2} = 1.5(2)^2 - 8$

$= -2m/s^2$

The retardation is $2m/s^2$

F 12-7

$a = (4t^2 - 2)\ m/s^2$

$V = \int a\,dt = \int 4t^2 - 2$

$= \frac{4t^3}{3} - 2t + c$

$P = \int v\,dt = \int \frac{4t^3}{3} - 2t + c$

$= \frac{4t^4}{12} - \frac{2t^2}{2} + ct$

$P = \frac{1}{3}t^4 - t^2 + ct + d$ - (1)

when $t = 0$ $P = -2$

Putting $t = 0$ in eqn (1) $\therefore -d = -2$

when $t = 2$, $P = -20$.

Substituting $t = 2$, $P = -20$ and $d = -2$ in eqn (1)

$-20 = \frac{1}{3}(2)^4 - 2^3 + c(2) - 2$

$-20 = 5.3 - 4 + 2c - 2$

$-20 = -0.7 + 2c$

$-20 + 0.7 = 2c$

$c = \frac{-20 + 0.7}{2}$

$c = -9.65$

$\therefore P = \frac{1}{3}t^4 - t^2 - 9.65t - 2$

when $t = 4$, $P = \frac{1}{3}(4)^4 - 4^2 - 9.65(4) - 2$

$P = 28.73m$

F 12-8

$V = (20 - 0.05s^2)\ ms^{-1}$

$a = dv/dt = \frac{dv}{ds} \cdot \frac{ds}{dt}$

$\frac{\delta v}{\delta s} = -0.15$; $\frac{\delta s}{\delta t} = v = (20 - 0.05s^2)$

$\therefore a = (-0.1s)(20 - 0.05s^2)$

when $s = 15$

$a = (-0.1 \times 15)(20 - 0.05 \times 15^2)$

$= -1.5 \times 8.75$

$= -13.125\ ms^{-2}$

The retardation of $13.125\ ms^{-2}$