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18/ENG05/003
MECHATRONICS ENGINEERING
ENG 234

F12-3 $v = (4t - 3t^2)\,m/s$

$\int v.dt = s = 2t^2 - t^3 + c$

But $t = 0\,sec$ when $s = 0\,m$

$0 = 2(0)^2 - (0)^3 + c$

$c = 0$

Therefore, $s = 2t^2 - t^3$

At $t = 4sec$

$s = 2(4)^2 - (4)^3$

$s = -32m$

F12-4 $v = (0.5t^3 - 8t)\,m/s$

$a = \frac{dv}{dt} = (1.5t^2 - 8)\,m/s^2$

At $t = 2sec$

$a = (1.5(2)^2 - 8)\,m/s^2$

$= (6 - 8)\,m/s^2$

$= -2\,m/s^2$

F12-7 $a = (4t^2 - 2)\,m/s^2$

$\int a = v = \frac{4t^3}{3} - 2t + c_1$

$$\int v = s = \frac{t^4}{3} - t^2 + C_1 t + C_2$$

At $t = 0\,sec$, $s = -2m$

Therefore,

$$-2 = \frac{(0)^4}{3} - (0)^2 + C_1(0) + C_2$$

$$C_2 = -2$$

$$s = \frac{t^4}{3} - t^2 + C_1 t - 2$$

At $t = 2sec$, $s = -20m$

$$-20 = \frac{(2)^4}{3} - (2)^2 + C_1(2) - 2$$

$$2C_1 = -20 + \frac{2}{3}$$

$$C_1 = -\frac{29}{3}$$

Given that,

$$s = \frac{t^4}{3} - t^2 - \frac{29t}{3} - 2$$

At $t = 4sec$,

$$s = \frac{(4)^4}{3} - (4)^2 - \frac{29(4)}{3} - 2$$

$$s = \frac{86}{3}$$

$$s = 28.67m$$

F12-8 $v = (20 - 0.05s^2)\ m/s$

$$a = v\left(\frac{dv}{ds}\right)$$

where $\frac{dv}{ds} = -0.1s$

At $s = 15\ m$,

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

$a = (20 - 11.25)(-1.5)$

$a = 8.75(-1.5)$

$a = -13.13\ m/s^2$