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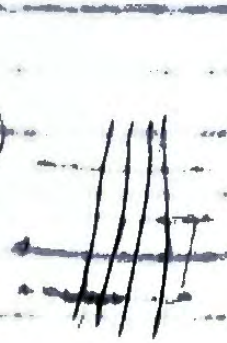
Mechatronics Eng
16/ENG05/009
ENG 281

1) $P = \frac{E^2}{R}$

Given $E = 200$ Volts $R = 8$ Ohms
$\delta E = -5$ Volts $\delta R = 0.2$ Ohms

$P = F(E, R)$

$\delta P = \frac{\partial P}{\partial E} \cdot dE + \frac{dP}{dR} \cdot \delta R$



$\frac{dP}{dE} = \frac{2E}{R}$, $\frac{dP}{dR} = -E^2 R^{-2} = -\frac{E^2}{R^2}$

$\frac{\partial P}{\partial R} = \frac{-200^2}{8^2} = \frac{40000}{64} = -625$

$\therefore \delta P = \frac{2E}{R} \times \delta E + \left[\frac{-E^2}{R^2} \times \delta R\right]$

$\delta P = \left[\frac{2 \times 200}{8} \times (-5)\right] + \left[-625 \times 0.2\right]$

$\delta P = [50 \times -3] + [-625 \times 0.2]$

$\therefore \delta P = -375$ Watts //

2) $y = kwd^3$

$$\frac{\delta y}{\delta w} = \frac{kd^3}{t^3}, \quad \frac{dy}{dd} = \frac{4kwd^3}{t^3}, \quad \frac{dy}{dt} = -\frac{3kwd^4}{t^4}$$

$$dy = \frac{dy}{dw} \cdot dw + \frac{dy}{dd} \cdot dt$$

$$dy = \left[\frac{kd^4}{t^3} \times \frac{3}{100} w\right] + \left[\frac{4kwd^3}{t^3} \times \frac{2.5}{100} d\right] + \left[\frac{-3kwd^4}{t^4} \times \frac{4}{100}\right]$$

$$dy = \left[\frac{kwd^4}{t^3} \times \frac{3}{100}\right] + \left[\frac{4wd^4}{t^3} \times \left[\frac{4 \times 2.5}{100}\right]\right] + \left[\frac{kwd^4}{t} \times \left[\frac{4 \times -3}{100}\right]\right]$$

$$dy = \frac{kwd^4}{t^3}\left[\frac{3}{100} + \frac{10}{100} + \frac{-12}{100}\right] \Rightarrow dy = kwd$$

$$dy = \frac{kwd^4}{t^3}\left[\frac{3}{100} + \frac{10}{100} + \frac{-12}{100}\right] \Rightarrow dy = \frac{kwd^4}{t^3}\left[\frac{3}{100} + \frac{10}{100} - \frac{12}{100}\right]$$

$$dy = \frac{kwd^4}{t^3}\left[\frac{1}{100}\right]$$

where $y = \frac{kwd^4}{t^3}$

$\therefore \delta y = 1\%$ of y.