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ENG 281
Civil Engineering
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1. $P = \frac{E^2}{R}$ $E = 200v$ $R = 8ohms$

$\delta E = -5v$

$\delta R = 0.2\ ohms$

$\frac{\partial P}{\partial E} = \frac{2E}{R}$ $\frac{dP}{dR} = E^2R^{-1} = -E^2R^{-2}$ or $\frac{-E^2}{R^2}$

$$\delta p = \frac{dp}{dE}\delta E + \frac{dP}{dR}\delta R$$

$$= \frac{2E}{R}(-5v) + \left(\frac{-E^2}{R^2}(0.2)\right)$$

$$= \frac{2(200)(-5)}{8} + \left(\frac{(-200)^2 \times 0.2}{8^2}\right)$$

$$= \frac{-2000}{8} + \frac{40000}{64} \times 0.2$$

$$= \frac{-2000 + 1000}{8}$$

$$\delta p = -125\,H$$

2. $y = \frac{Kwd^4}{t^3}$

$\delta w = +3\%\, w$

$\delta d = +2.5\%\, d$

$\delta t = +4\%\, t$

$$\frac{dy}{dw} = \frac{kd^4}{t^5} \qquad \frac{dy}{dd} = \frac{4kwd^3}{t^3} \qquad \frac{dy}{dt} = -\frac{3kwd^4}{t^4}$$

$$\delta y = \frac{dy}{dw}\delta w + \frac{dy}{dd}\delta d + \frac{dy}{dt}\delta t$$

$$\delta y = \frac{kd^4}{t^3}(0.03w) + \frac{4kwd^3}{t^3}(0.025d) + \left(\frac{3k}{t^4}\right.$$

$$\delta y = \frac{0.03kwd^4}{t^3} + \frac{0.1kwd^4}{t^3} - \frac{0.12kwd^4}{t^5}$$

$$= \frac{kwd^4}{t^3}(0.03 + 0.1 - 0.12)$$

$$\delta y = \frac{0.01kwd^4}{t^3}$$

$$\delta y = \pm 1\% y$$