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16/ENG05/010

Mechatronics Engineering

ENG 281

Assignment III

1

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

$$E = 200V$$
$$R = 8\Omega$$

$$\Delta E = -5V$$
$$\Delta R = 0.2\Omega$$

$$\frac{dP}{dE} = \frac{2E}{R}$$

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

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

$$= \frac{2E}{R} \cdot (-5V) + \frac{-E^2}{R^2} \cdot (0.2)$$

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

$$= \frac{400}{8} \cdot (-5) + \left( \frac{40000}{64} \right) \cdot 0.2$$

$$= 50(-5) + 625(0.2)$$

$$= -250 + 125$$

$$\Delta P = -125W$$

$$2 \quad y = \frac{kwd^4}{t^3}$$

$$\Delta w = +3\% w$$

$$\Delta d = +2.5\% d$$

$$\Delta t = +4\% t$$

$$\frac{dy}{dw} = \frac{k d^4}{t^3} \quad \frac{dy}{dd} = \frac{4k w d^3}{t^3} \quad \frac{dy}{dt} = \frac{-3k w d^4}{t^2}$$

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

$$\Delta y = \frac{k d^4}{t^3} (0.03w) + \frac{4k w d^3}{t^3} (0.025d) + \frac{(-3k w d^4)}{t^2} (0.04)$$

$$\Delta y = 0.03 \frac{k w d^4}{t^3} + 0.1 \frac{k w d^4}{t^3} - 0.12 \frac{k w d^4}{t^3}$$

$$\Delta y = \frac{k w d^4}{t^3} (0.03 + 0.1 - 0.12)$$

$$\Delta y = \frac{k w d^4}{t^3} (0.01)$$

$$\Delta y = 0.01 \frac{k w d^4}{t^3}$$

$$\Delta y = \pm 1\% y$$