TAKAI JESSE ABAGAM.
16/ENG02/056.
Computer Engineering.
23/10/2017.
ENGINEERING MATHS.

1. The power P dissipated in a resistor is given as in Equation (1)

$$P = \frac{E^2}{R} \quad \text{——— (1)}$$

If E = 200 volts and R = 8 ohms, find the change in P resulting from a drop of 5 volts in E and an increase of 0.2 ohm in R.

Solution.

$$P = \frac{E^2}{R} \quad \therefore \frac{\partial P}{\partial R} = \frac{-E^2}{R^2} \text{ and } \frac{\partial P}{\partial E} = \frac{2E}{R}$$

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

where $\frac{\partial P}{\partial R} = \frac{-E^2}{R^2} = \frac{-200^2}{8^2} = \frac{40,000}{64} = 625$

$$\frac{\partial P}{E} = \frac{2E}{R} = \frac{2 \times -200}{8} = \frac{-400}{8} = -50.$$

$\delta R = 0.2R$, $\delta E = 5V$

$$\therefore \delta P = \frac{\partial P}{\partial R} \cdot \delta R + \frac{\partial P}{\partial E} \cdot \delta E$$

$$= -625 \times 0.2 + -50 \times 5$$

$$= -125 - 250$$

$$\delta P = -375$$

2. The deflection y at the centre of a circular plate suspended at the edge and uniformly loaded is given in Equation (2).

$$Y = \frac{KWd^4}{t^3}$$

Where W = total load, d = diameter of plate, t = thickness and K is a constant.

Calculate the approximate percentage change in Y if W is increased by 3 percent, d is increased by 2½ percent and t is increased by 4 percent.

Sol

$$Y = \frac{KWd^4}{t^3} \quad \therefore \frac{\partial Y}{\partial W} = \frac{Kd^4}{t^3}, \frac{\partial Y}{\partial d} = \frac{4Wd^3}{t^3}, \frac{\partial W}{\partial t} = \frac{-3Kwd^4}{t^4}$$

$$\delta Y = \left(\frac{Kd^4}{t^3} \times \frac{3\omega}{100}\right) + \left(\frac{4Wd^3}{t^3} \times \frac{2.5d}{100}\right) + \left(\frac{-3Kwd^4}{t^4} \times \frac{4t}{100}\right)$$

$$= \frac{3Kwd^4}{100t^3} + \frac{10Kwd^4}{100t^3} - \frac{12Kwd^4}{100t^3}$$

$$= \left(\frac{3}{100} + \frac{10}{100} - \frac{12}{100}\right) \frac{Kwd^4}{t^3}$$

$$= \frac{1}{100} \frac{Kwd^4}{t^3}$$

δy = 1% of Y.