NWANGWO NWACHUKWU 16/ENG04/036 Elect/Elect

ENG 281

1) The Power dissipated in a resistor is given as in equation $P = \frac{E^2}{R} = E^2 R^{-1}$

If $E = 200V$ and $R = 8\Omega$, find change in P from a drop of 5V in E and increase of 0.2Ω in R

$P = \frac{E^2}{R}$ & $\partial E = -5V$, $\partial R = 0.2\Omega$

$\frac{\partial P}{\partial E} = \frac{2E}{R}$ ~~=>~~, $\frac{\partial P}{\partial R} = \frac{-E^2}{R^2} = -1 \times E^2 \times R^{-1-1}$

$= -E^2 \times R^{-2}$

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

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

$\frac{\partial P}{\partial E} = \frac{2(200)}{8\Omega} = \frac{400}{8} = 50$

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

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

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

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

$\delta P = -375$ ∴ P reduces by -375 watts.

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

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

where w = total load

d = diameter of plate

t = thickness ~~and K = constant~~

K = Constant

Calculate the approximate percentage change in y if w is increased by 3%, d is increased by 2½% and t is increased by 4%

Solve

$$y = Kwd^4 t^{-3}$$

$$\delta y = \frac{\partial y}{\partial w}\delta w + \frac{\partial y}{\partial d}\delta d + \frac{\partial y}{\partial t}\delta t$$

$$\frac{\partial y}{\partial w} = \frac{Kd^4}{t^3} \times \delta w = \frac{Kd^4}{t^3} \times \frac{3}{100} w \pm$$

$$\frac{\partial y}{\partial d} = \frac{4Kwd^3}{t^3} \times \delta d = \frac{4Kwd^3}{t^3} \times \frac{2.5}{100} d \pm$$

$$\frac{\partial y}{\partial t} = \frac{-3Kwd^4}{t^4} \times \delta t = \frac{-3Kwd^4}{t^4} \times \frac{4}{100} t \pm$$

$$\therefore \frac{Kd^4}{t^3}\left(\frac{3}{100}w\right) + \frac{4Kwd^3}{t^3} \times \left(\frac{2.5}{100}d\right) + \frac{-3Kwd^4}{t^4} \times \left(\frac{4t}{100}\right)$$

$$\therefore \frac{Kwd^4}{t^3}(0.03) + \frac{4Kwd^4}{t^3}(0.025) + \frac{-3Kwd^4}{t^4} \times \left(\frac{4t}{100}\right)$$

$$\frac{Kwd^4}{t^3}\left(0.03 + 4(0.025) + (-3(0.04))\right)$$

$$= \frac{Kwd^4}{t^3}(0.01)$$

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

$$\therefore dy = y(0.01)$$

$$\therefore y \text{ changed by } 1\%$$