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Computer Engineering
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1. The power P dissipated in a resistor is given as in equ (1)

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

If $E = 200V$ and $R = 8\Omega$ find the change in E resulting from a drop of 5v in E and an increase of 0.2Ω in R

Solution

$$P = E^2 R^{-1}$$

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

$$\frac{\delta P}{\delta E} = 2ER^{-1}$$

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

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

$$\delta P = \frac{2 \times 200}{8} \times 5 + \left[\frac{(-200)^2}{8} \times 1 \times 0.2\right]$$

$$\delta P = \frac{2000}{8} + \frac{8000}{64}$$

$$\delta P = 250 + 125$$

$$\delta P = 375 \text{ Watts}$$

The power P dissipated increased by 375 Watts

2. The deflection y at the centre of a circle plate suspended at the edge and uniformly loaded is equ (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 % change in y if w is increased by 3% and d is

increased by 2½% and t increased by 4%.

Solution

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

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

$$\frac{\partial y}{\partial w} = d^4 t^{-3}$$

$$\frac{\partial y}{\partial d} = 4d^3 w t^{-3}$$

$$\frac{\partial y}{\partial t} = -3t^{-4} w d^4$$

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

$$\delta y = d^4 t^{-3}\left[\frac{3w}{100}\right] + 4d^3 w t^{-3}\left[\frac{5d}{200}\right] - 3t^{-4} w d^4\left[\frac{4t}{100}\right]$$

$$\delta y = \frac{3d^4 t^{-5} w}{100} + \frac{20 d^4 w t^{-3}}{200} - \frac{12 t^{-3} w d^4}{100}$$

$$\delta y = \frac{Kwd^4}{t^3}\left[\frac{3}{100} + \frac{20}{200} - \frac{12}{100}\right]$$

$$\delta y = \frac{Kwd^4}{t^3}\left[6 + \frac{20}{200} - 24\right]$$

$$\delta y = \frac{Kwd^4}{t^3}\left[\frac{1}{100}\right]$$

$$\delta y = y\left[\frac{1}{100}\right]$$

∴ the percentage change in y is 1%