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Assignment

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

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

If E = 200 volts and R = 50ohms. find the change in P resulting from a 5volts in E and an increase of 0.2ohm in R

(2) The Deflection y at the Centre of a circular plate suspended at the edge and uniformly loaded is given in equation (2)

$$y = \frac{kwd^4}{t^3} \quad \text{——— (2)}$$

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 2% percent and t is increased by 4 percent.

Answers

(1) E = 200V
R = 8Ω
δP = ?
δE = 5V
δR = 0.2Ω

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

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

$$\delta p = \frac{2E}{R}\delta E - \frac{E^2}{R}\delta R$$

$$\delta W = \left(\frac{2\times100}{5}\times5\right)\cdot\left(\frac{5^2}{5}\times0.1\right)$$

$\delta P = 249.9 \text{ kN} \approx 250 \text{ kN}$

(c) $y = \frac{KWd^4}{t^3}$

$$\delta y = \pm\left[\frac{\partial y}{\partial W}\delta W + \frac{\partial y}{\partial d}\delta d + \frac{\partial y}{\partial t}\delta t\right]$$ where K is a constant

$\delta W = (0.05W) + W = 1.05W$

$\delta d = (0.025d) + d = 1.025d$

$\delta t = (0.04t) + t = 1.04t$

$$\delta y = K\left[\frac{d^4}{t^3}\times1.05W + \frac{4Wd^3}{t^3}\times1.025d - \frac{3Wd^4}{t^4}\times1.04t\right]$$

$$\delta y = \frac{KWd^4}{t^3}\left[1.05 + 4\times1.025 - 3\times1.04\right]$$

$\delta y = y\,[2.01]$

$\delta y\,\% = \frac{201}{100}y = 201\%$ of y