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16/ENG02/057

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

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

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

2) The deflection y at the centre of a circular plate suspended at the edge and uniformly loaded is given in 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 the increased by 2½ % and t is increased by 4%

Soln

$$P = \frac{E^2}{R} \quad ; \quad P = E^2 \cdot R^{-1}$$

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

$$\frac{dP}{dE} = 2ER^{-1}$$

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

$$\delta E = 5V \; ; \; \delta R = 0.2\Omega$$

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

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

$\delta p = 250 + 125$

$\delta p = 375$ Watts

The power P dissipated increased by 375 watts

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

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

$\frac{dy}{dw} = d^4t^{-3}$

$\frac{dy}{dd} = 4d^3wt^{-3}$

$\frac{dy}{dt} = -3t^{-4}wd^4$

$\delta y = \frac{dy}{dw} \times \delta w + \frac{dy}{dd} \times \delta d + \frac{dy}{dt} \times \delta t$

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

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

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

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

$\delta y = \frac{kwd^4}{t^3}\ \frac{1}{100}$

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

[Therefore the percentage change in y is 1%]