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1 The Power P dessipated in a resistor is given by $P = E^2/R$. If $E = 200$ volts and $R = 8$ ohms, find the change in P resulting from a drop of 5 volts in E and ~~and~~ an increase of 0.2 ohm in R

Ans

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

$$P = E^2 R^{-1} \qquad \frac{\partial P}{\partial R} = -\frac{E^2}{R^2}$$

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

$$= 2E/R$$

$R = 8$, $E = 200$, $\delta R = 0.2$, $\delta E = -5$

$$\delta P = \frac{(2)(200)(-5)}{8} - \frac{(200)^2(0.2)}{8^2}$$

$$-250 - 125$$

$$= -375 W$$

Power decreases by 375 watts

2 The deflection y at the centre of a circular plate suspended at the edge and uniformly loaded is given as

$$y = kwd^4/t^3$$

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

Ans

$\delta y = k\left(\frac{\partial y}{\partial w}\delta w + \frac{\partial y}{\partial d}\delta d + \frac{\partial y}{\partial t}\delta t\right)$

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

$\delta w = 3w/100$, $\delta d = 5d/200$, $\delta t = 4t/100$

$\delta y = \left(\frac{kd^4}{t^3}\right)\left(\frac{3w}{100}\right) + \frac{k4wd^3}{t^3}\left(\frac{5d}{200}\right) - \frac{k3wd^4}{t^4}\left(\frac{4t}{100}\right)$

$\delta y = \frac{3kwd^4}{100t^3} + \frac{20wd^4k}{200t^3} - \frac{12kwd^4}{100t^3}$

$\delta y = \frac{1}{100}\left(\frac{3kwd^4}{t^3} + \frac{10kwd^4}{t^3} - \frac{12kwd^4}{t^3}\right)$

$\delta y = \frac{1}{100}(3y + 10y - 12y)$

$\delta = 1/100\,(1y)$

$\delta y = 1/100\, y$

y increases by 1/100 percent