NAME: OLOROTI GRACE -T.
DEPARTMENT: COMPUTER ENGINEERING
MATRIC NUMBER: 16/ENG02/045
COURSE: Engineering Maths CENG

Assignment

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

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

If E = 200volts and R = 8ohms, find the change in P resulting from a drop of 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)

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

where w = total load, d = diameter of pole, t = thickness and k is a constant: Calculate the approximate percentage change in y if w is increased by 3 per cent, d is increased by 2½ percent and t is increased by 4 percent.

Solution.

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

R = 8ohms  E = 200volts.

$\delta R = 0.2$ohm - $\delta E$ = 5volts

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

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

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

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

$\delta P = 2ER^{-1} \times 5 + -E^2R^{-2} \times 0.2$

$= 2 \times 200 \times \frac{1}{8} \times 5 + (-200)^2 \times \frac{1}{8^2} \times 0.2$

$= \frac{400 \times 5}{8} + \frac{40000 \times 0.2}{8^2}$.

$= \frac{2000}{8} + \frac{8000}{8^2}$

$= 250 + 125$

$= 375$ watts.

Change in P = 375 watts

2) $y = \frac{Kwd^4}{t^3}$ K = constant

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

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

$\delta w = +3\% = \frac{+3w}{100}$

$\delta d = +2\frac{1}{2}\% = +\frac{5}{2} \div 100 = +\frac{5}{2} \times \frac{1}{100} = \frac{5d}{200}$

$\delta t = +4\% = \frac{4t}{100}$

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

$\delta y = \left(Kd^4t^{-3} \times \frac{3w}{100}\right) + \left(4Kwd^3t^{-3} \times \frac{5d}{200}\right) + \left(-3Kwd^4t^{-4} \times \frac{4t}{100}\right)$

$= \frac{3wKd^4t^{-3}}{100} + \frac{20Kwd^4t^{-3}}{200} - \frac{12Kwd^4t^{-3}}{100}$

$wKd^4t^{-3}\left[\frac{3}{100} + \frac{20}{200} - \frac{12}{100}\right]$

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

$= wKd^4t^{-3}\left[\frac{2}{200}\right]$

$= wKd^4t^{-3}\left[\frac{1}{100}\right]$

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

∴ the change in percentage of y = 1%.