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16/ENG04/1014
ELect/Elect ENG
ENG 281

Question

1. The power P dissipated in a resistor is given as eqn(i)
$P = E^2/R$
If E = 200volts and R = 8ohms, find the change in P resulting from a drop of 5 volts in E and an increase of 0.2ohm in R.
2. The deflection y at the centre of a circular plane suspended at the edge and uniformly
$$y = \frac{kwd^4}{t^3}$$
where
w = total load
d = diameter
t = thickness
k = Constant
calculate the approximate percentage change in y if w is increased by 3 percent, d is increak by 2½ percent and t is increased by 4 percent

Solu

1. $P = E^2/R$
$= E^2R^{-1}$
$$\Delta P = \frac{\Delta P}{\Delta E}\Delta E + \frac{\Delta P}{\Delta R}\Delta R$$
$$\frac{\Delta P}{\Delta E} = 2ER^{-1} = \frac{2E}{R} = \frac{2(200)}{8} = 50$$
$$\frac{\Delta P}{\Delta R} = -E^2R^{-2} = -\frac{E^2}{R^2} = -\frac{(200)^2}{8^2} = -625$$

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

$$\Delta P = 50(-5) + (-625)(0.2)$$

$$\Delta P = -250 - 125$$

$$\Delta P = -375 N$$

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

$$\Delta y = \frac{\Delta y}{\Delta w}\Delta w + \frac{\Delta y}{\Delta d}\Delta d + \frac{\Delta y}{\Delta t}\Delta t$$

$$\frac{\Delta y}{\Delta w} = kd^4 t^{-3} = \frac{kd^4}{t^3}$$

$$\frac{\Delta y}{\Delta t} = 4kwd^3 t^{-3} = \frac{4kwd^3}{t^3}$$

$$\frac{\Delta y}{\Delta t} = -3kwd^4 t^{-4} = \frac{-3kwd^4}{t^4}$$

$$\Delta w = 3/100 \text{ of } w = \frac{3w}{100}$$

$$\Delta d = \frac{2.5}{100} \text{ of } d = \frac{2.5d}{100}$$

$$\Delta t = \frac{4}{100} \text{ of } t = \frac{4t}{100}$$

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

$$\Delta y = \frac{kd^4}{t^3}\left[\frac{3w}{100}\right] + \frac{4kwd^3}{t^3}\left[\frac{2.5d}{100}\right] + \left[\frac{-3kwd^4}{t^4}\right]\left[\frac{4t}{100}\right]$$

$$\Delta y = \frac{kwd^4}{t^3}\left[\frac{3}{100}\right] + \frac{kwd^4}{t^3}\left[\frac{10}{100}\right] - \frac{kwd^4}{t^3}\left[\frac{12}{100}\right]$$

$$\Delta y = \frac{kwd^4}{t^3}\left[\frac{3}{100} + \frac{10}{100} \quad \frac{-12}{100}\right]$$

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

recall that

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

$$\Delta y = y\left[\frac{1}{100}\right] = 1 \text{ percent of } y$$