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16/ENG01/005

chemical Engineering

ENG 281

Solutions

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

$E = 200$ volts $\quad R = 8$ ohms

$\delta E = -5$ volts $\quad \delta R = 0.2$ ohms

$P = f(E, R)$

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

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

$\therefore \delta P = \frac{2E}{R} \cdot \delta E + \left(\frac{E^2}{-R^2} \cdot \delta R\right)$

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

$= -250 - 125$

$\therefore \delta P = -375$ klatts

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

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

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

$= \left(\frac{Kd^4}{t^3} \cdot \frac{3w}{100}\right) + \left(\frac{4Kwd^3}{t^3} \cdot \frac{2.5d}{100}\right) + \left(\frac{-3Kwd^4}{t^4} \cdot \frac{4t}{100}\right)$

$= \left(\frac{3}{100} \cdot \frac{Kwd^4}{t^3}\right) + \left(\frac{Kwd^4}{t^3} \cdot \frac{4 \times 2.5}{100}\right) + \left(\frac{4 \times -3}{100} \cdot \frac{Kwd^4}{t^3}\right)$

$= \frac{Kwd^4}{t^3}\left(\frac{3}{100} + \frac{10}{100} - \frac{12}{100}\right)$

$= \frac{Kwd^4}{t^3}\left(\frac{1}{100}\right)$

$\therefore \delta y = 1\%$ of y.