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17/ENG06/014
MECHATRONICS ENGINEERING
EEE 322 ELECTRIC CIRCUIT II

i, A parallel resonant circuit has $R = 100\,k\Omega$, $L = 20\,mH$ & $C = 5\,mF$
Calculate $\omega_o, \omega_1, \omega_2, Q$ & B

$$\rightarrow \omega_o = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{(20\times10^{-3})\times(5\times10^{-3})}}$$
$$= 100\ k\,rads^{-1}$$

$$\rightarrow B = \frac{\omega_o}{Q} = \frac{1}{RC} = \frac{1}{100\times(5\times10^{-3})}$$
$$= 2\,k\,rads^{-1}$$

From above, $\omega_o = 100\,k\,rads^{-1}$ & $B = 2\,k\,rads^{-1}$

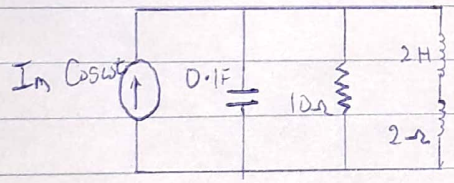
$$\therefore Q = \frac{\omega_o}{B} = \frac{100\times10^3}{2\times10^3} = 50$$

Since $Q \geq 10$

$$\rightarrow \omega_1 = \omega_o - \frac{B}{2} = 100\times10^3 - \frac{2\times10^3}{2} = 99\,k\,rads^{-1}$$

$$\rightarrow \omega_2 = \omega_o + \frac{B}{2} = 100\times10^3 + \frac{2\times10^3}{2} = 101\,k\,rads^{-1}$$

ii, Determine the resonant frequency of the circuit below



The input admittance is; $Y = j\omega 0.1 + \frac{1}{10} + \frac{1}{2+j\omega 2}$

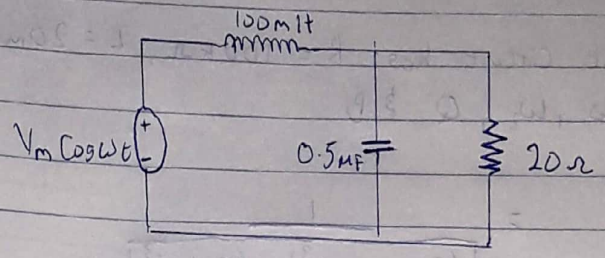
$$= 0.1 + j\omega 0.1 + \frac{2 - j\omega 2}{4 + 4\omega^2}$$

At Resonance

$$Im(Y) = 0$$
$$\omega_o 0.1 = \frac{2\omega_o}{4+\omega_o^2} = 0$$

$w_o = 2 rads^{-1}$

iii, Calculate the resonant frequency of the circuit below



$$\frac{20 + \frac{2000}{jw}}{20 + \frac{2000}{jw}} = \frac{40000}{20jw + 2000} - \frac{40000}{20jw * 2000} + \frac{(20jw - 2000)}{(20jw - 2000)}$$

$$= \frac{80000jw - 80000000}{-400jw - 4000000} + 100mH$$

At resonance of the imaginary part at $w = 0$

$$\frac{80,000jw}{-400jw - 4000000} + jw(100 \times 10^{-3})$$

$$= 800000w + [-40w^2] - 400000w$$

$$= 400000 = 40w^2 = 0$$

$$-40w^2 = -400000$$

$$w^2 = \frac{-400000}{-40} = 10000$$

$$w = \sqrt{10000} = 100 rads^{-1}$$