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17/ENG02/066
COMPUTER ENGINEERING
Assignment

i) A parallel resonant circuit has $R = 100K\Omega$, $L = 20mH$ and $C = 5nF$. Calculate w_0, w_1, w_2, Q and B

Solution

$$w_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{(20\times10^{-3})\times(5\times10^{-3})}}$$

$$= 100Krad/s$$

$$B = \frac{w_0}{Q} = \frac{1}{RC} = \frac{1}{100\times(5\times10^{-3})}$$

$$= 2Krad/s$$

$w_0 = 100Krad/s$

$B = 2Krad/s$

$$\therefore Q = \frac{w_0}{B} = \frac{100\times10^3}{2\times10^3} = 50$$

Since $Q \geq 10$

$$w_1 = w_0 - \frac{B}{2} = 100\times10^3 - \frac{2\times10^3}{2} = 99Krad/s$$

$$w_2 = w_0 + \frac{B}{2} = 100\times10^3 = \frac{2\times10^3}{2} = 101Krad/s$$

ii) Determine the resonant frequency of the circuit below

The input admittance is

$$Y = jw0.1 + \frac{1}{10} + \frac{1}{2+jw^2}$$

$$= 0.1 + jw0.1 + \frac{2-jw^2}{4+4w^2}$$

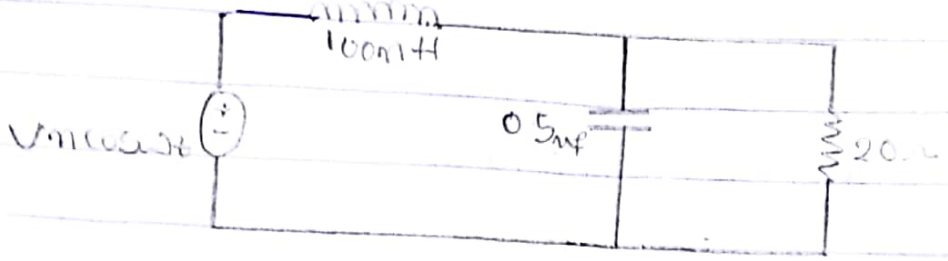
at Resonance

$Im(Y) = 0$

$W \cdot 0.1 = \frac{2W_0}{4+W_0^2} = 0$

$W_0 = 2 rad/s$

3) Calculate the resonant frequency of the circuit below



Solution

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

$$= \frac{800000Jw - 80000000}{-400Jw - 4000000} + 100mH$$

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

$$\frac{80,0000Jw}{-400Jw - 4000000} + Jw[100 \times 10^{-3}J]$$

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

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

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

$$w^2 = 10000$$

$$w = \sqrt{10000}$$

$$w = 100 rad/s$$