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17/ENG05/030
MECHATRONICS ENGINEERING
ENG322 ASSIGNMENT

i) A parallel resonant circuit has $R = 100\ K\Omega$, $L = 20mH$, and $C = 5mF$. Calculate W_o, W_1, W_2, Q and B

Solution

$$- W_o = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{(20 \times 10^{-3}) \times (5 \times 10^{-3})}}$$

$$= 100\ K\,rad/s$$

$$- B = \frac{W_o}{Q} = \frac{1}{RC} = \frac{1}{100 \times (5 \times 10^{-3})}$$

$$= 2\ K\,rad/s$$

From the equations above we know that $W_o = 100\ K\,rad/s$ and $B = 2K_{rad}$

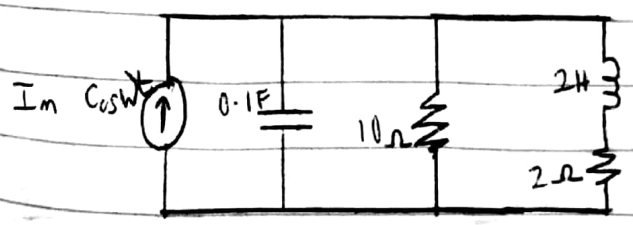
$$\therefore Q = \frac{W_o}{B} = \frac{100 \times 10^3}{2 \times 10^3} = \cancel{50\,rad/s}\ 50$$

Since $Q \geq 10$

$$- W_1 = W_o - \frac{B}{2} = 100 \times 10^3 - \frac{2 \times 10^3}{2} = 99\,K\,rad/s$$

$$W_2 = W_o + \frac{B}{2} = 100 \times 10^3 + \frac{2 \times 10^3}{2} = 101\,K\,rad/s$$

ii) Determine the resonant frequency of the circuit below:



The input admittance is

$$Y = jw\,0.1 + \frac{1}{10} + \frac{1}{2+jw2}$$

$$= 0.1 + jw\,0.1 + \frac{2 - jw2}{4 + 4w^2}$$

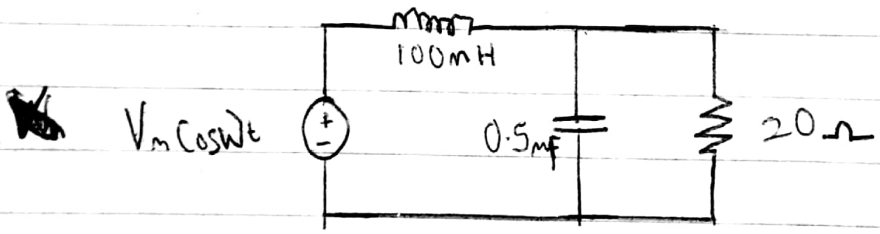
at Resonance

$$I_m(Y) = 0$$

$$w_o\,0.1 = \frac{2w_o}{4 + w_o^2} = 0$$

$$w_o = 2\ rad/s$$

3) Calculate the resonant frequency of the circuit below



Solution

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

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

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

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

$$= 800000\,w + [-40w^2] - 4000000w$$

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

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

$$w^2 = 10000$$

$$w = \sqrt{10000}$$

$$w = 100 \text{ rad/s}$$