Otu Expo - Expanyong
17/ENG05/011
Mechatronics

Circuit theory

① A parallel resonant circuit has $R = 100\ k\Omega$, $L = 20mH$, and $C = 5mf$

Calculate ω_c, ω_1, ω_2, Q and B

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

$$= 100\ krad/s$$

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

$$= 2\ krad/s$$

From the equations above we know that $\omega_o = 100\ krad$

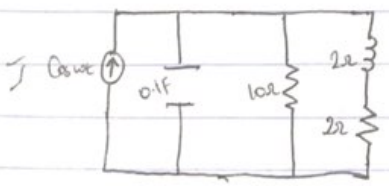
$$\therefore Q = \frac{\omega_o}{B} = \frac{100\times10^3}{2\times10^3} = 50$$

$Q \geq 10$

$$-\omega_1 = \omega_o - \frac{B}{2} = 100\times10^3 - \frac{2\times10^3}{2} = 99\ krad/s$$

$$\omega_2 = \omega_o - \frac{B}{2} = 100\times10^3 + \frac{2\times10^3}{2} = 101\ krad/s$$

Determine the resonant frequency of the circuit below.



The Input admittance is

$$Y = j\omega 0.1 + \frac{1}{10} + \frac{1}{2+j\omega_2}$$

$$= 0.1 + j\omega 0.1 + \frac{2 - j\omega_2}{4 + 4\omega^2}$$

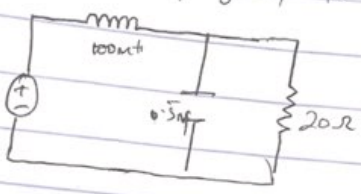
At Resonance

$$Im(y) = 0$$

$$\omega_0 0.1 = \frac{2\omega_0}{4 + \omega_0^2} = 0$$

$$\omega_0 = 2 \text{ rad/s}$$

Calculate the resonant frequency of the circuit below



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

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

At Resonance of the Imaginary parts at $\omega = 0$

$$\frac{800000j\omega}{-400j\omega - 4000000} + j\omega\left[100 \times \omega^{-3}\right]$$

$$= 800000\omega + \left[-40\omega^2\right] - 4000000$$

$$= 400000 - 40\omega^2 = 0$$

$$-40\omega^2 = -400000$$

$$\omega^2 = 10000$$

$$\omega = \sqrt{10000}$$

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