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Mechatronics Engineering

17/eng05/018

300 Level

EEE 322 Circuit theory

1 r = 100 kΩ l = 20mH c = 5µf

w1 = 1/√lc

= 1/√(20 x10^-3)x(5x10^-9)

=100,000rads/s

ii) w1 = w0 – b/2

q = r / w1c = 100x10^3 / (100x10^30) x (20x10^-3)

=50

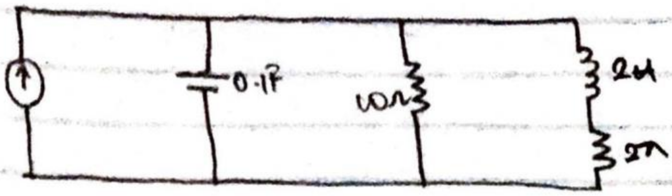
2 B = wo/Q = 100x10^3/50 = 2000rads/s

= w1 = 100 x 10^3 – 2000/2
=w1 = 9900rad/s

iii) w2 = w0 + b/2

100x10^3 + 2000/2

W2 = 101,000rads/s



The input admittance is:

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

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

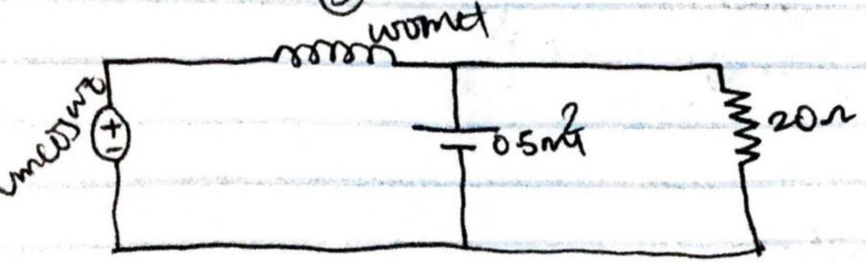
At resonance.

$Im(Y) = 0$

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

$\omega_0 = 2 rad/s$

(3)



$Z = R + j\omega L + 1/j\omega C$

$R // C$

$Z = j\omega 100\times10^{-3} + \left(20 \times \frac{1}{j\omega(0.5\times10^{-3})}\right) \div \left(\frac{20}{1} + \frac{1}{j\omega 0.5\times10^{-3}}\right)$

(4)

$= \left(\frac{20}{j\omega(0.5\times10^{-3})} \div \frac{20(0.5\times10^{-3})j\omega + 1}{j\omega(0.5\times10^{-3})}\right)$

$= \frac{20}{j\omega(0.5\times10^{-3})} \times \frac{(0.5\times10^{-3})j\omega}{0.01j\omega + 1}$

$Z = j\omega 100\times10^{-3} + \left(\frac{20}{j\omega(0.5\times10^{-3})} \times \frac{j\omega(0.5\times10^{-3})}{1+0.01j\omega}\right)$

$= j\omega 100\times10^{-3} + \frac{20}{1+0.01j\omega}$

$$\frac{400}{1+0.01j\omega} \times \frac{1-0.01j\omega}{1-0.01j\omega}$$

z:+

$$z = j\omega 100\times10^{-3} + \frac{20-0.2j\omega}{1+1\times10^{-4}\omega^2}$$

@ resonance magnitude of z_I $z=0$ $\{\omega=\omega_0\}$

$$z \to \omega_0 100\times10^{-3} - \frac{0.2\omega_0}{1+1\times10^{-4}\omega_0^2} = 0$$

$$\to \frac{0.2\omega_0}{1+1\times10^{-4}\omega_0^2} = \omega_0 100\times10^{-3}$$

(b)

$$\therefore\ 0.2\omega_0 = \omega_0(100\times10^{-3})(1+1\times10^{-4}\omega_0^2)$$

$$0.2\omega_0 = 100\times10^{-3}\omega_0 + 100\times10^{-7}\omega_0^3$$

$$0.2 = 100\times10^{-3} + 100\times10^{-7}\omega_0^2$$

$$0.2-100\times10^{-3} = 100\times10^{-7}\omega_0^2$$

$$\omega_0 = \sqrt{\frac{1\times10^{-1}}{100\times10^{-7}}}$$

$$\therefore\ \omega_0 = 100\,\text{rad/s}$$