Solution of ECE 300 Test 11 S09

1. (a) At a frequency of $\omega = 1000$ rad/s, find the numerical magnitude and angle of the input impedance Z_{in} of the circuit below.

$Z_{c1} = 1/j\omega C_1 = -j50\Omega$, $Z_{c2} = 1/j\omega C_2 = -j200\Omega$, $Z_L = j\omega L = j100\ \Omega$

$$Z_{in} = \left(j100 - j200\right) \| 80 - j50 = \frac{-j8000}{80 - j100} - j50 = 101.513\angle -61.28°$$

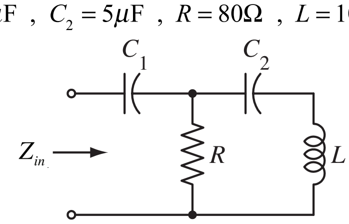
(b) There is a positive value of ω at which the real part of the input impedance is zero. Find that numerical value of ω.

$$Z_{in} = \left(j0.1\omega - j2\times 10^5/\omega\right) \| 80 - j5\times 10^4/\omega$$

If $j0.1\omega - j2\times 10^5/\omega = 0$, then the real part of Z_{in} will be zero.

Solving for ω we get $\omega = 1414.2$ rad/s.

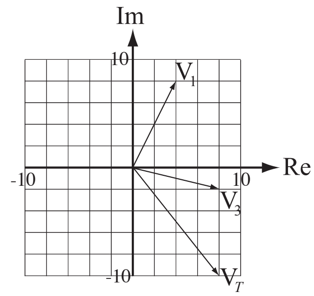
$C_1 = 20\mu\text{F}$, $C_2 = 5\mu\text{F}$, $R = 80\Omega$, $L = 100\text{mH}$

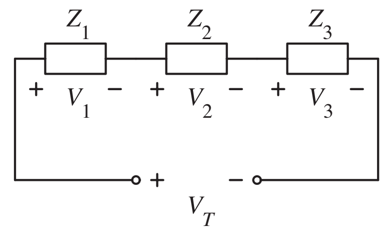


2. With reference to the circuit and the phasor diagram below, find the numerical magnitude and angle of V_2.

$V_1 = 4 + j8$, $V_3 = 8 - j2$, $V_T = 8 - j10$

$V_2 = V_T - V_1 - V_3 = 8 - j10 - (4 + j8) - (8 - j2) = -4 - j16 = 16.492\angle -104.04°$





Solution of ECE 300 Test 11 S09

1. (a) At a frequency of $\omega = 1000$ rad/s, find the numerical magnitude and angle of the input impedance Z_{in} of the circuit below.

$Z_{c1} = 1/j\omega C_1 = -j50\Omega$, $Z_{c2} = 1/j\omega C_2 = -j200\Omega$, $Z_L = j\omega L = j50\ \Omega$

$$Z_{in} = (j50 - j200) \| 80 - j50 = \frac{-j12000}{80 - j150} - j50 = 103.945\angle -53.19°$$

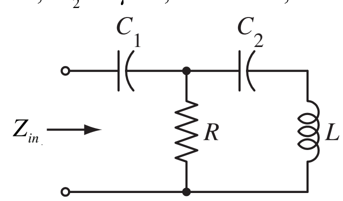
(b) There is a positive value of ω at which the real part of the input impedance is zero. Find that numerical value of ω.

$$Z_{in} = (j0.05\omega - j2 \times 10^5 / \omega) \| 80 - j5 \times 10^4 / \omega$$

If $j0.05\omega - j2 \times 10^5 / \omega = 0$, then the real part of Z_{in} will be zero.

Solving for ω we get $\omega = 2000$ rad/s.

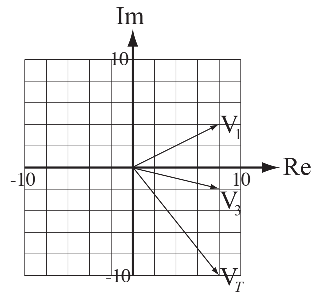
$C_1 = 20\mu\text{F}$, $C_2 = 5\mu\text{F}$, $R = 80\Omega$, $L = 50\text{mH}$

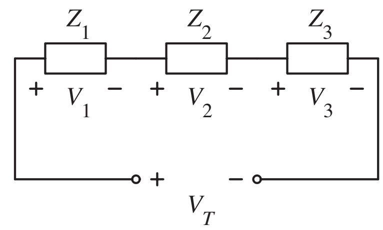


2. With reference to the circuit and the phasor diagram below, find the numerical magnitude and angle of V_2.

$V_1 = 8 + j4$, $V_3 = 8 - j2$, $V_T = 8 - j10$

$V_2 = V_T - V_1 - V_3 = 8 - j10 - (8 + j4) - (8 - j2) = -8 - j12 = 14.422\angle -123.69°$





Solution of ECE 300 Test 11 S09

1. (a) At a frequency of $\omega = 1000$ rad/s, find the numerical magnitude and angle of the input impedance Z_{in} of the circuit below.

$Z_{c1} = 1/j\omega C_1 = -j50\Omega$, $Z_{c2} = 1/j\omega C_2 = -j200\Omega$, $Z_L = j\omega L = j80\ \Omega$

$$Z_{in} = (j80 - j200) \| 80 - j50 = \frac{-j9600}{80 - j120} - j50 = 103.07\angle -57.5°$$

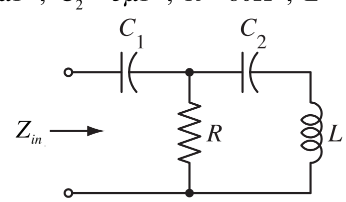
(b) There is a positive value of ω at which the real part of the input impedance is zero. Find that numerical value of ω.

$$Z_{in} = (j0.08\omega - j2\times 10^5/\omega) \| 80 - j5\times 10^4/\omega$$

If $j0.08\omega - j2\times 10^5/\omega = 0$, then the real part of Z_{in} will be zero.

Solving for ω we get $\omega = 1581.1$ rad/s.

$C_1 = 20\mu F$, $C_2 = 5\mu F$, $R = 80\Omega$, $L = 80mH$



2. With reference to the circuit and the phasor diagram below, find the numerical magnitude and angle of V_2.

$V_1 = 8 + j4$, $V_3 = 2 + j8$, $V_T = 8 - j10$

$V_2 = V_T - V_1 - V_3 = 8 - j10 - (8 + j4) - (2 + j8) = -2 - j22 = 22.091\angle -95.19°$