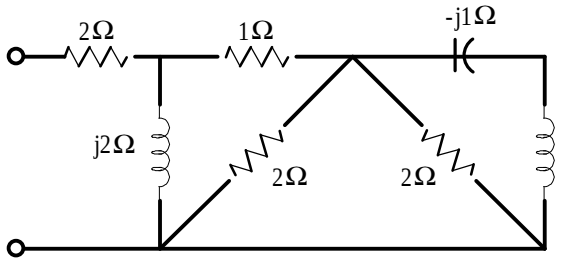
Problem 7.17

Find **Z** for the network shown.

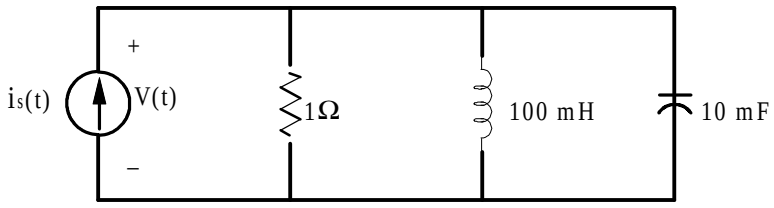


Suggested Solution

$$Z = 2 + 2j \,\|\, (1+1\|\, j) = 2 + 2j \,\|\, (1.5 + 0.5j) = 2 + \frac{2j-4}{-1+4j} = 2.83\angle 16.92°\,\Omega$$

Problem 7.21

Draw the frequency domain circuit and calculate v(t) for the circuit shown if $I_s(t)=20\cos(377t+120°)$ A.



Suggested Solution

$$Z = j\omega L = j37.7\,\Omega$$

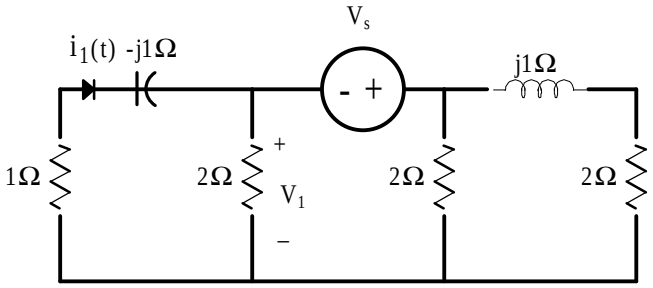
$$Z_c = \frac{1}{j\omega C} = \frac{1}{j3.77}\,\Omega$$

$$V = I\left[\frac{1}{\frac{1}{R}+\frac{1}{Z_L}+\frac{1}{Z_C}}\right] = \frac{2\angle 120°}{1-\frac{j}{37.7}+j3.77} = \frac{2\angle 120°}{1+j3.74} = \frac{2\angle 120°}{3.84\angle 75.03°} = 0.52\angle 44.91°\,V$$

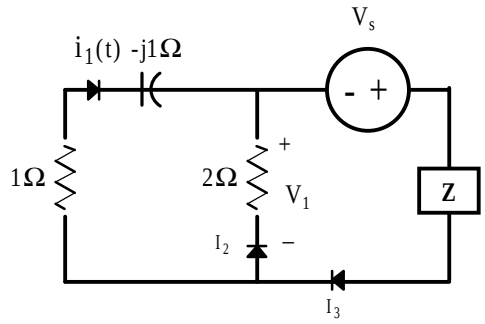
$$v(t) = 0.52\cos(377t + 44.97°)V$$

Problem 7.38

Find V_S in the network shown if $I_0=2\angle 0°$ A.



Suggested Solution



$$Z = \frac{2(2+j)}{4+j}$$

$$V_1 = I_1(1-j) = 2-j2$$

$$I_2 = \frac{V_1}{2} = 1-j$$

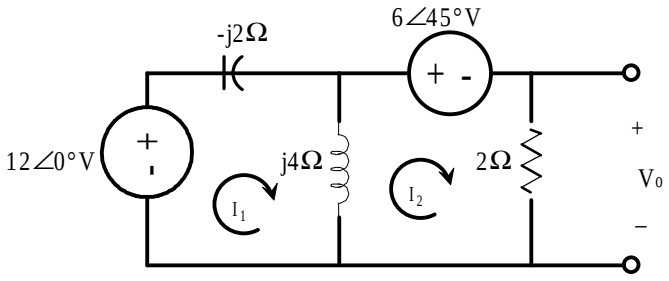
$$I_3 = I_1 + I_2 = 2+1-j = 3-j$$

$$V_2 = I_3 Z = (3-j)\left(\frac{4+2j}{4+j}\right) = \frac{14+j2}{4+j}$$

$$V_S = V_1 + V_2 = 2-2j+\frac{14+j2}{4+j} = 5.58\angle -14°V$$

Problem 7.51

Use mesh analysis to find V_0 in the circuit shown.



Suggested Solution

$V_0 = 2I_2$

mesh equations

$12 = I_1(j2) + I_2(-j4)$

$-6\angle 45^\circ = -j4I_1 + I_2(2 + j4)$

matrix form

$$\begin{bmatrix} j2 & -j4 \\ -j4 & 2+j4 \end{bmatrix}\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 12 \\ 6\angle -135^\circ \end{bmatrix}$$

Solve for I_2

$$I_2 = \frac{\begin{bmatrix} j2 & 12 \\ -j4 & 6\angle 135^\circ \end{bmatrix}}{\begin{bmatrix} j2 & -j4 \\ -j4 & 2+j4 \end{bmatrix}} = \frac{12\angle -45^\circ + 48\angle 90^\circ}{j4 - 8 + 16} = 4.52\angle 51.3^\circ A$$

$V_0 = 2I_2 = 9.04\angle 51.3^\circ V$