Last Lecture → Impedance

The ratio of the phasor voltage V to the phasor current I.

$$Z = \frac{V}{I} \;\; [Ohms]$$

$$= \frac{V_M \angle \theta_v}{I_M \angle \theta_i} = \frac{V_M}{I_M} \angle (\theta_v - \theta_i) = Z \angle \theta_z$$

Resistance

Reactance

$$Z \angle \theta_z = R + jX$$

KVL & KCL are valid in the frequency domain!

PASSIVE ELEMENT	IMPEDANCE
R	$\mathbf{Z} = R$
L	$\mathbf{Z} = j\omega L = jX_L,\ X_L = \omega L$
C	$\mathbf{Z} = \frac{1}{j\omega C} = -\frac{j}{\omega C} = -jX_C,\ X_C = \frac{1}{\omega C}$

Series → Equivalent Impedance

$$Z_s = Z_1 + Z_2 + \cdots + Z_n$$

Parallel → Equivalent Impedance

$$\frac{1}{Z_p} = \frac{1}{Z_1} + \frac{1}{Z_2} + \cdots + \frac{1}{Z_n}$$

Last Lecture → Admitance

The ratio of the phasor current I to the phasor voltage V.

$$Y = \frac{I}{V} = \frac{1}{Z}\ [Siemens]$$

Conductance

$$Y\langle\theta_y = G + jB$$

Susceptance

KVL & KCL are valid in the frequency domain!

PASSIVE ELEMENT	IMPEDANCE
R	$\mathbf{Z} = R$
L	$\mathbf{Z} = j\omega L = jX_L,\ X_L = \omega L$
C	$\mathbf{Z} = \frac{1}{j\omega C} = -\frac{j}{\omega C} = -jX_C,\ X_C = \frac{1}{\omega C}$

Parallel → Equivalent Admittance

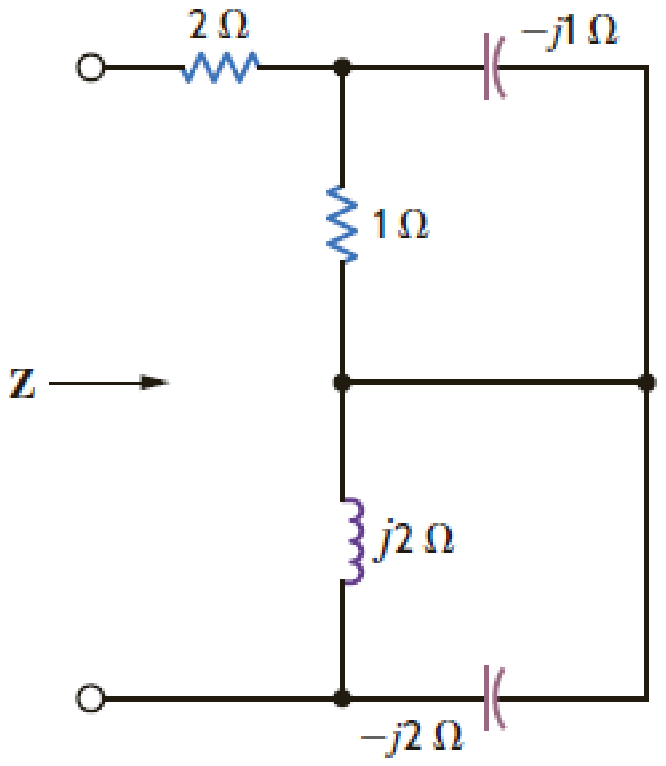
$$Y_p = Y_1 + Y_2 + \cdots + Y_n$$

Series → Equivalent Admittance

$$\frac{1}{Y_s} = \frac{1}{Y_1} + \frac{1}{Y_2} + \cdots + \frac{1}{Y_n}$$

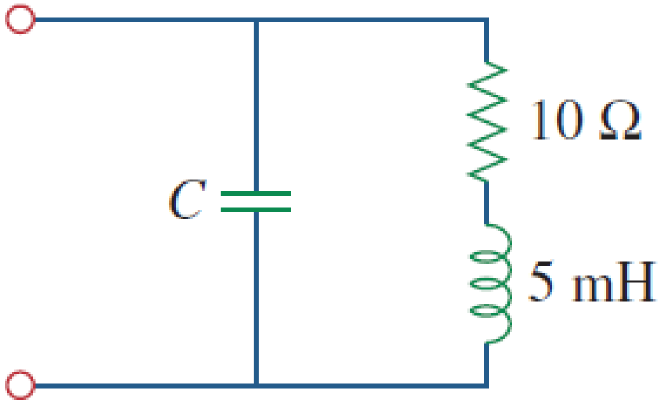
Problem 8.17

Find the frequency-domain impedance, Z, shown below.



Problem

An industrial load is modeled as a series combination of an inductor and a resistance as shown in the provided figure. Calculate the value of a capacitor C across the series combination so that the net impedance is resistive at a frequency of 2 kHz.



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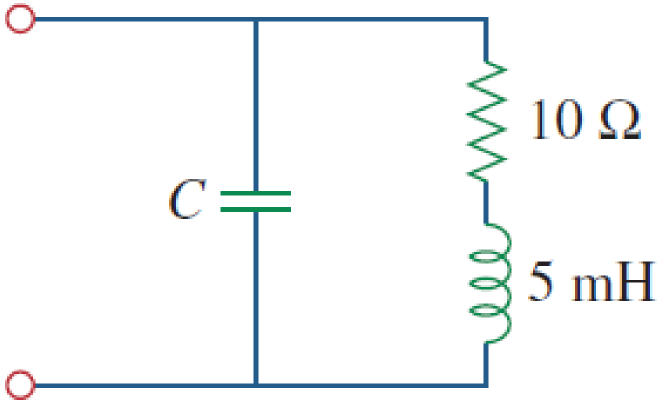
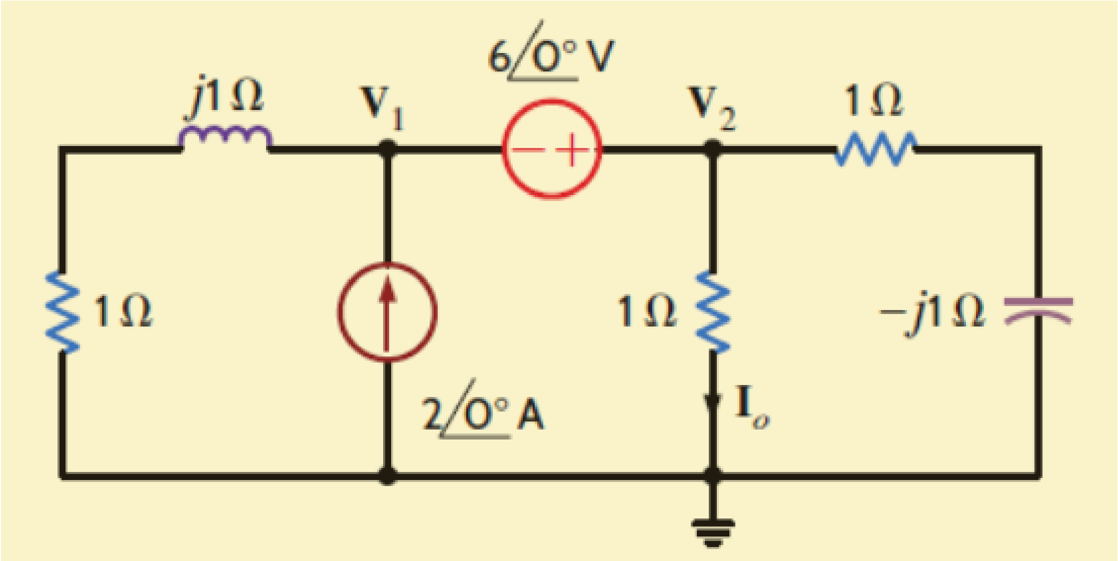


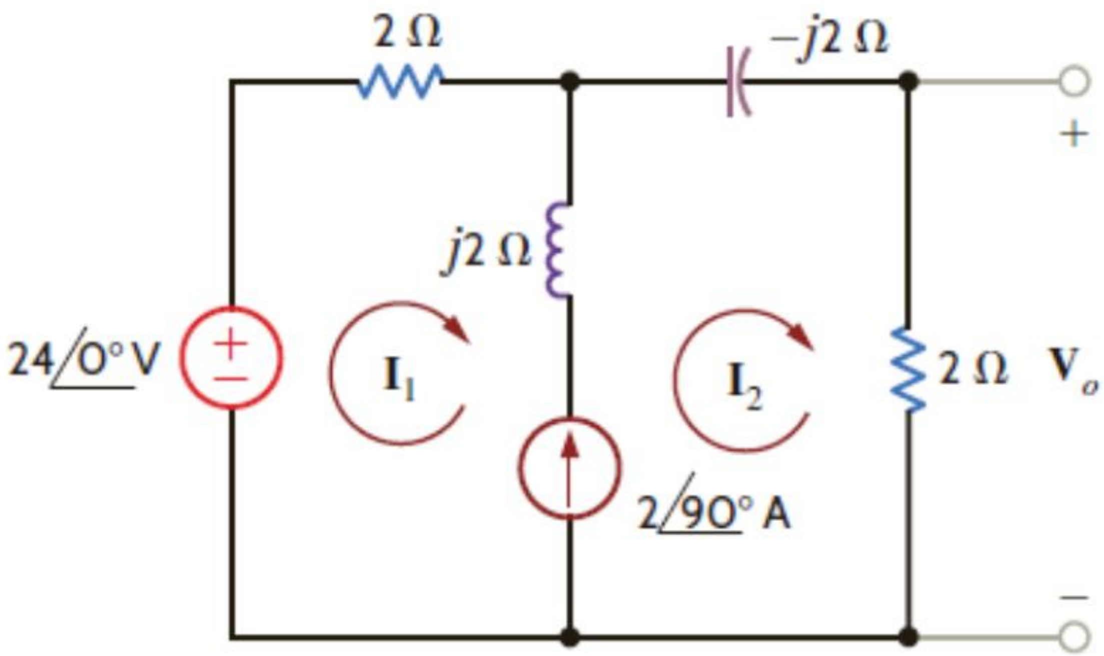
Example 8.15

For the given network determine I_0 using nodal analysis.



Learning Assessment E8.20

For the given network use (a) mesh equations and (b) Thevenin's theorem to find V_o.



Learning Assessment E8.23

For the given network use (a) superposition and (b) source transformation to find V_o.