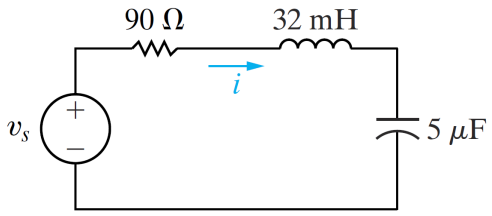
Birzeit University
Faculty of Engineering and Technology
Department of Electrical and Computer Engineering
Circuit Analysis – ENEE 2304
Quiz #4

1 February 2023 **Dr. Jaser Sa'ed** **Time: 10 min**

Student Name: **ID Number:**

A 90 Ω resistor, a 32 mH inductor, and a 5 μF capacitor are connected in series across the terminals of a sinusoidal voltage source, as shown in the Fig. . The steady-state expression for the source voltage v_s is $750\cos(5000t + 30^\circ)$ V.



a) Construct the frequency-domain equivalent circuit.

b) Calculate the steady-state current i by the phasor method.

Solution

a) From the expression for v_s, we have $\omega = 5000$ rad/s. Therefore the impedance of the 32 mH inductor is

$$Z_L = j\omega L = j(5000)(32 \times 10^{-3}) = j160\ \Omega,$$

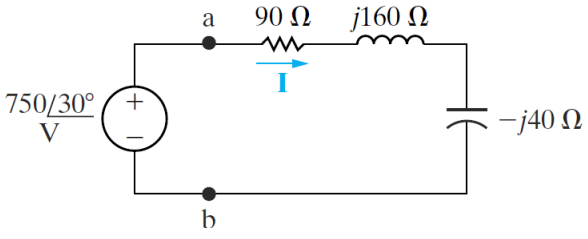
and the impedance of the capacitor is

$$Z_C = j\frac{-1}{\omega C} = -j\frac{10^6}{(5000)(5)} = -j40\ \Omega.$$

The phasor transform of v_s is

$$\mathbf{V}_s = 750\angle 30^\circ\ \text{V}.$$

Figure 9.16 illustrates the frequency-domain equivalent circuit of the circuit shown in Fig. 9.15.



b) We compute the phasor current simply by dividing the voltage of the voltage source by the equivalent impedance between the terminals a,b. From Eq. 9.45,

$$Z_{ab} = 90 + j160 - j40$$
$$= 90 + j120 = 150\angle 53.13^\circ\ \Omega.$$

Thus

$$\mathbf{I} = \frac{750\angle 30^\circ}{150\angle 53.13^\circ} = 5\angle -23.13^\circ\ \text{A}.$$

We may now write the steady-state expression for i directly:

$$i = 5\cos(5000t - 23.13^\circ)\ \text{A}.$$