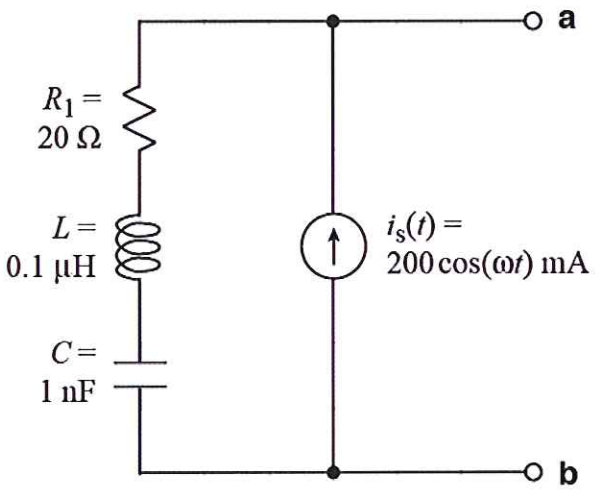
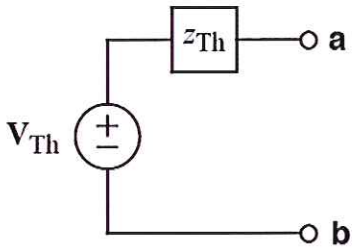
Ex:



Find the Thevenin equivalent of the above circuit in the frequency domain. That is, find the values of phasor $\mathbf{V}_{Th}$ and impedance z_{Th} in the equivalent circuit below.

Note: $\omega = 200$ Mr/s

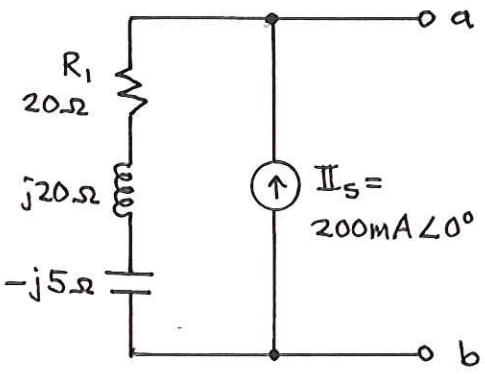


sol'n: We convert to the frequency-domain.

$$\mathbb{I}_s = 200\,mA \angle 0^\circ \quad \text{(phasor)}$$

$$z_L = j\omega L = j\ 200Mr/s \cdot 0.1\mu H = j\,20\,\Omega$$

$$z_C = \frac{-j}{\omega C} = \frac{-j}{200Mr/s \cdot 1nF} = -j\,5\,\Omega$$



$V_{Th} = V_{a,b}$ in above circuit. $\mathbb{I}_S$ flows thru R_1, z_L and z_C, creating voltage drop $V_{a,b} = V_{Th}$.

$$V_{Th} = \mathbb{I}_S \left(R_1 + j\omega L - \frac{j}{\omega C} \right) = 200\,mA\angle 0^\circ \left(20\Omega + j15\Omega \right)$$

or

$$V_{Th} = \frac{1}{5} A\angle 0^\circ \left(25\Omega \angle 37.1^\circ \right) = 5V \angle 37.1^\circ$$

or

$$V_{Th} = 4 + j3 \; V$$

For z_{Th}, we turn off $\mathbb{I}_S$ (= open) and look in from a, b.

$$z_{Th} = R_1 + j\omega L - \frac{j}{\omega C} = 20\Omega + j15\Omega$$