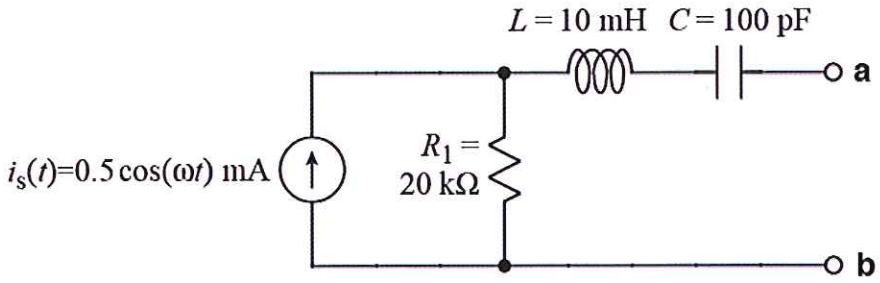
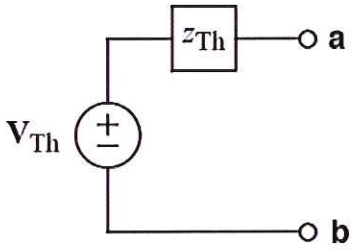
Ex:



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: $\omega = 500\,\text{kr/s}$

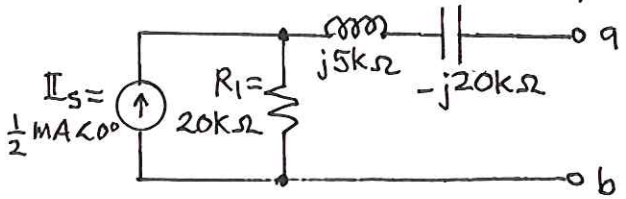


soln: We use the frequency-domain picture of the circuit.

$$\mathbb{I}_s = \tfrac{1}{2} \angle 0^\circ \text{ mA} \qquad (\text{phasor for } i_s(t))$$

$$z_L = j\omega L = j\ 500\,\text{kr/s} \cdot 10\text{mH} = j5\,\text{k}\Omega$$

$$z_C = \frac{-j}{\omega C} = \frac{-j}{500\,\text{kr/s} \cdot 100\text{pF}} = \frac{-j\ \Omega}{50\mu} = -j20\,\text{k}\Omega$$



$V_{Th} = V_{a,b}$ for above circuit.

No current flows in L and C, so no V-drop across L and C, and I_s flows thru R_1.

$V_{a,b} = V$ across $R_1 = I_s R_1 = \frac{1}{2} mA \angle 0^\circ \cdot 20k\Omega$

or

$V_{Th} = 10\angle 0^\circ \; V$

To find Z_{Th}, we look in from a, b with I_s off, which is an open.

$$Z_{Th} = R_1 + Z_L + Z_C = 20k\Omega + j5k\Omega - j20k\Omega$$

$$Z_{Th} = 20k\Omega - j15k\Omega$$