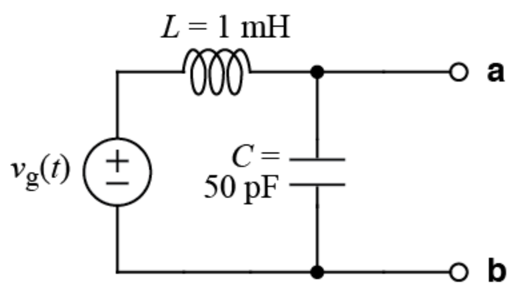
Ex:



$$v_g(t) = 6\cos(20\text{M}t) \text{ V}$$

a) Draw a frequency-domain equivalent of the above circuit. Show a numerical phasor value for $i_g(t)$, and show numerical impedance values for R, L, and C. Label the dependent source appropriately.

b) Find the Thevenin equivalent (in the frequency domain) for the above circuit relative to terminals **a** and **b**. Give the numerical phasor value for $\mathbf{V}_{\text{Th}}$ and the numerical impedance value of z_{Th}.

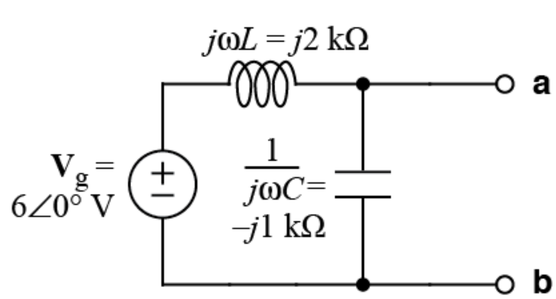
SOL'N: a) The phasor for the voltage source is a real number (no phase shift).

$$\mathbf{V}_\text{g} = 6\angle 0° \text{V}$$

From the expression for $v_\text{g}(t)$, we have ω = 20 Mr/s. We use this to calculate the impedance of the L and C.

$$j\omega L = j20\text{M}(1\text{m})\Omega = j20\,\text{k}\Omega$$

$$\frac{1}{j\omega C} = \frac{1}{j20\text{M}(50\,\text{pF})}\Omega = \frac{1}{j1\text{m}} = -j1\text{k}\Omega$$



b) The Thevenin voltage is the voltage across **a** and **b** with no load attached. We have a simple **V**-divider.

$$\mathbf{V}_{\text{Th}} = \mathbf{V}_{\text{ab}} \frac{-j1\,\text{k}\Omega}{j20\,\text{k}\Omega + -j1\,\text{k}\Omega} = 6\angle 0^\circ\,\text{V} \frac{-1}{20-1} = \frac{6}{19}\angle \pm 180^\circ\,\text{V}$$

To find the Thevenin impedance, we turn off the voltage source, which becomes a wire, and look in from the **a** and **b** terminals. We see the impedances in parallel.

$$z_{\text{Th}} = -j1\,\text{k}\Omega \,\|\, j20\,\text{k}\Omega = j1\,\text{k}\Omega \cdot (-1 \,\|\, 20) = j1\,\text{k}\Omega \cdot \frac{-20}{19} = -j\frac{20}{19}\,\text{k}\Omega$$