



The Islamic Faculty of Engineering

Department of Electrical Engineering

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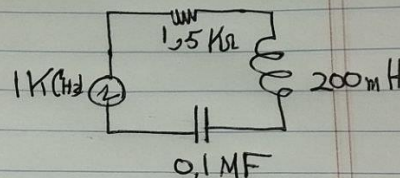
Question 1(Theoretical)

Series AC Circuit



Question: Consider a series AC circuit connected to sinusoidal voltage source with a peak voltage $V_m = 10\text{V}$ and $f = 1\text{KHz}$

① calculate (Z) for R, C, L



$$Z_R = R = 1500\Omega \quad \text{and} \quad Z_C = \frac{1}{j\omega C}$$

$$\omega = 2\pi f = 2 \times \pi \times 1000 = 6283.18 \frac{\text{rad}}{\text{s}} \quad \text{and} \quad Z_L = j\omega L = j 1256.63\Omega$$

$$Z_C = \frac{1}{j\omega C} = -j1591.54\Omega \quad \text{and} \quad Z_L = j\omega L = j 1256.63\Omega$$

② Calculate V_{Rms} of the source

$$V_{\text{Rms}} = \frac{V_m}{\sqrt{2}} = \frac{10}{\sqrt{2}} = 5\sqrt{2}\text{V}$$

$$\text{or } V_{\text{Rms}} = 7.07\text{V}$$

③ Determine the RMS current (I_{rms}) expected to flow through each component

Series $\rightarrow I_R = I_L = I_C = I_{rms}$ $I_{rms} = \frac{V_{rms}}{Z_T}$

$Z_T = R + X_j \rightarrow \phi \text{ between } Z_L \text{ and } Z_C = 180^\circ \rightarrow Z_{C/L} = Z_L - Z_C$

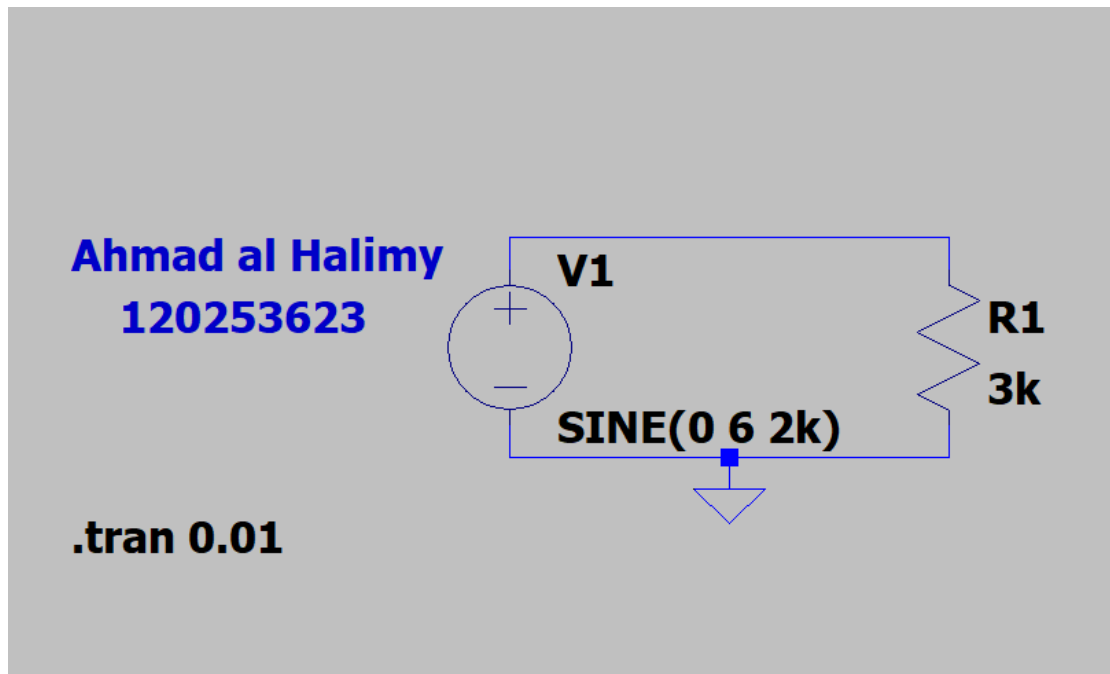
$Z_{net \text{ c/L}} = Z_L - Z_C = 1256.63 - 1591.54 = -334.91$

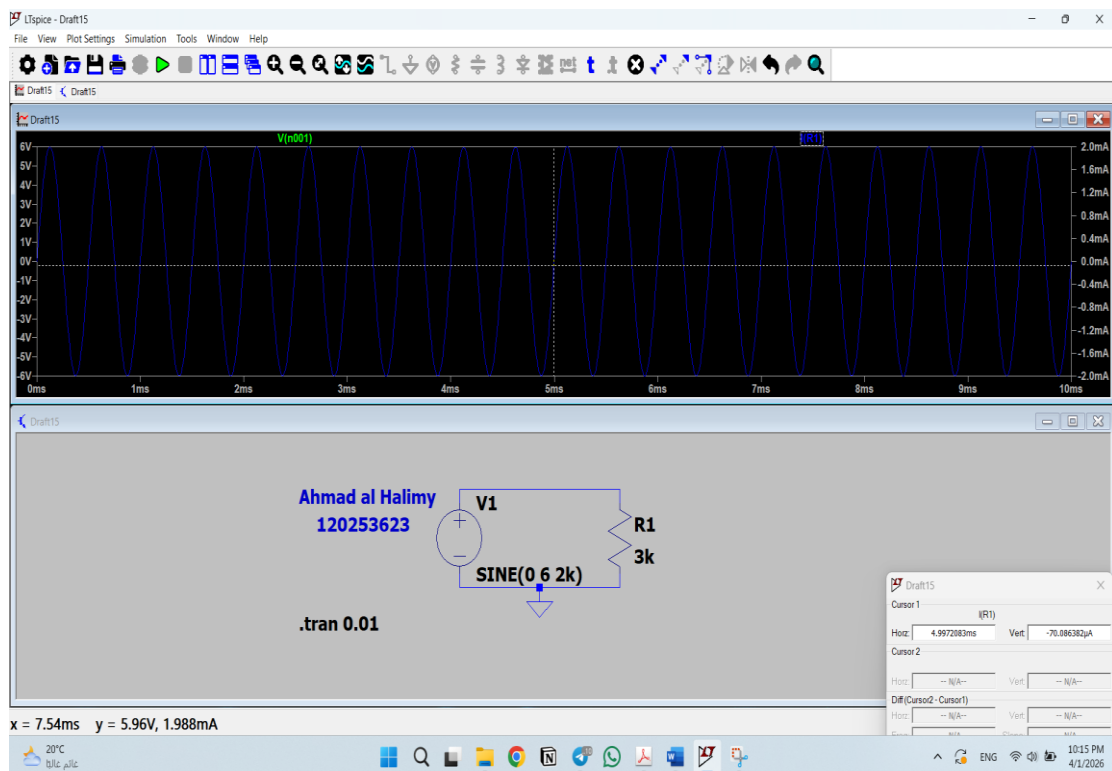
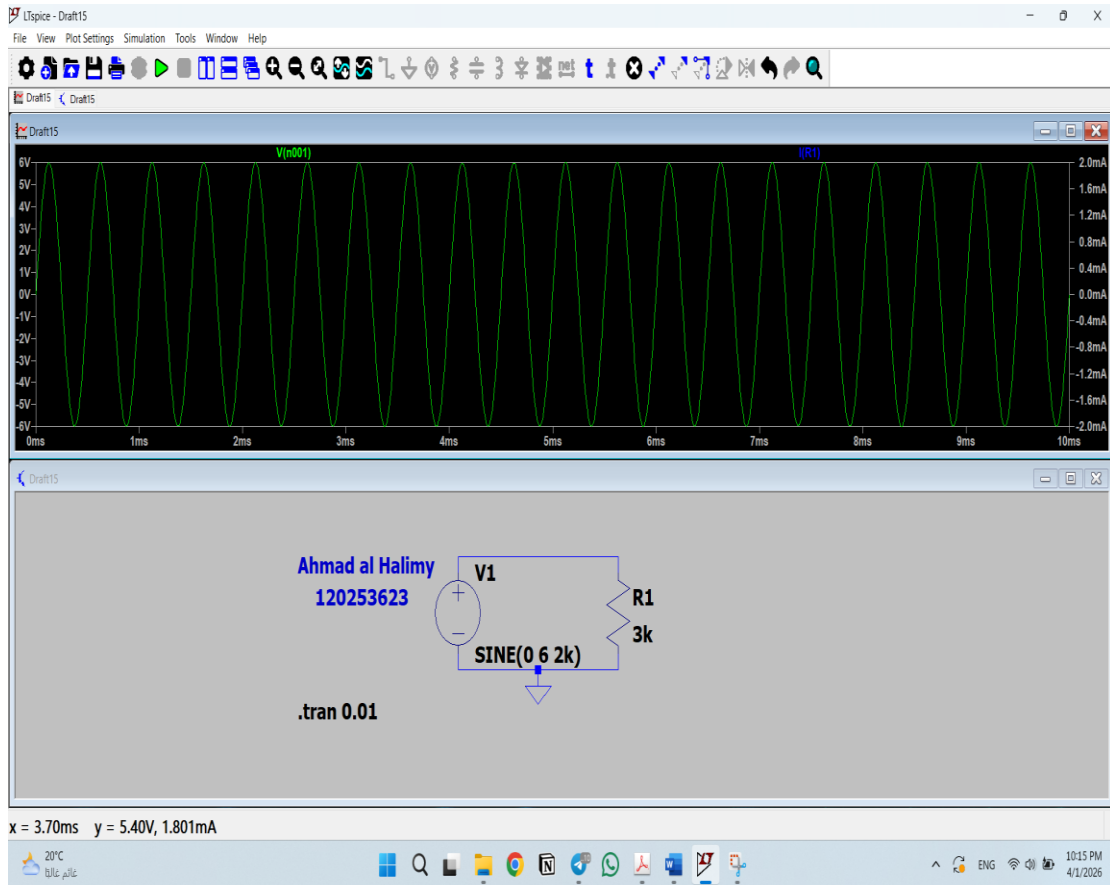
$|Z| = \sqrt{Z_R^2 + Z_{net}^2} = \sqrt{1500^2 + (-334.91)^2} = 1536.93$

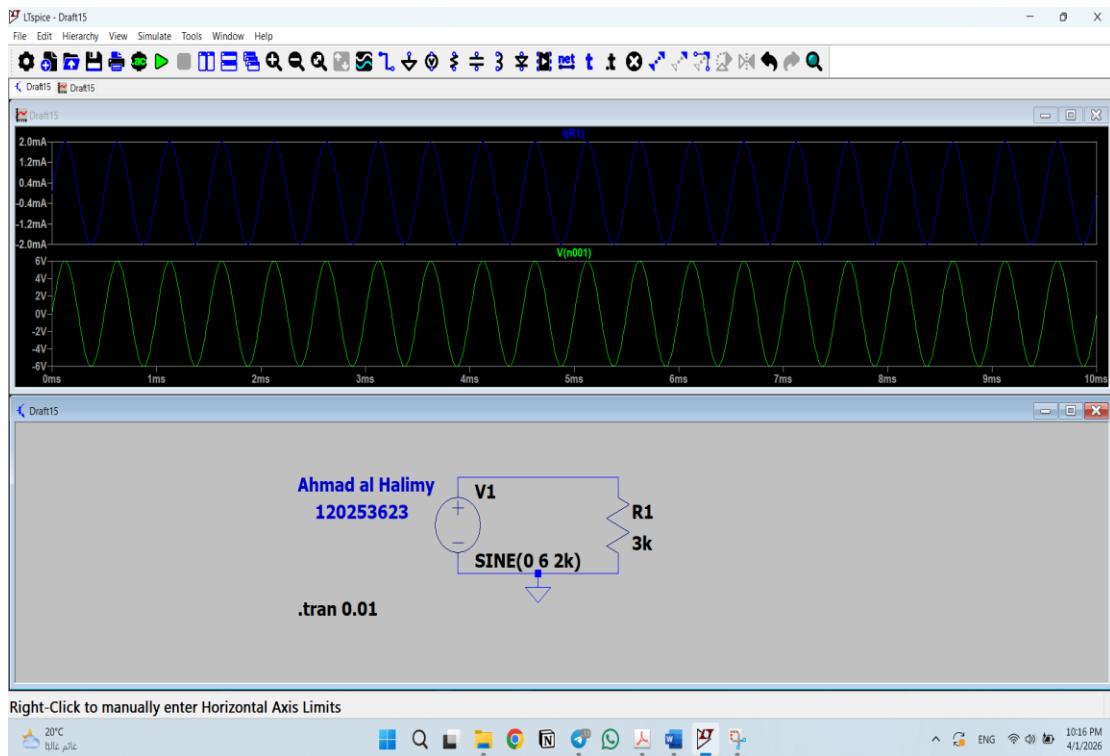
$I_{rms} = \frac{7.07}{1536.93} = 4.60 \times 10^{-3} \text{ A} = 4.6 \text{ mA}$

Question 2(partical)

Circuit (1)

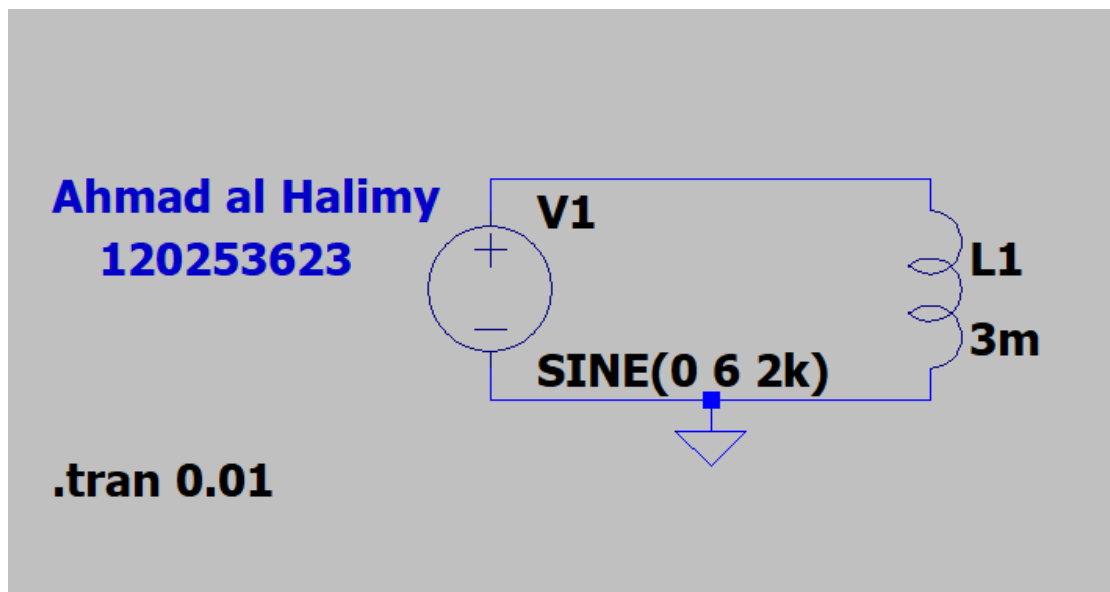


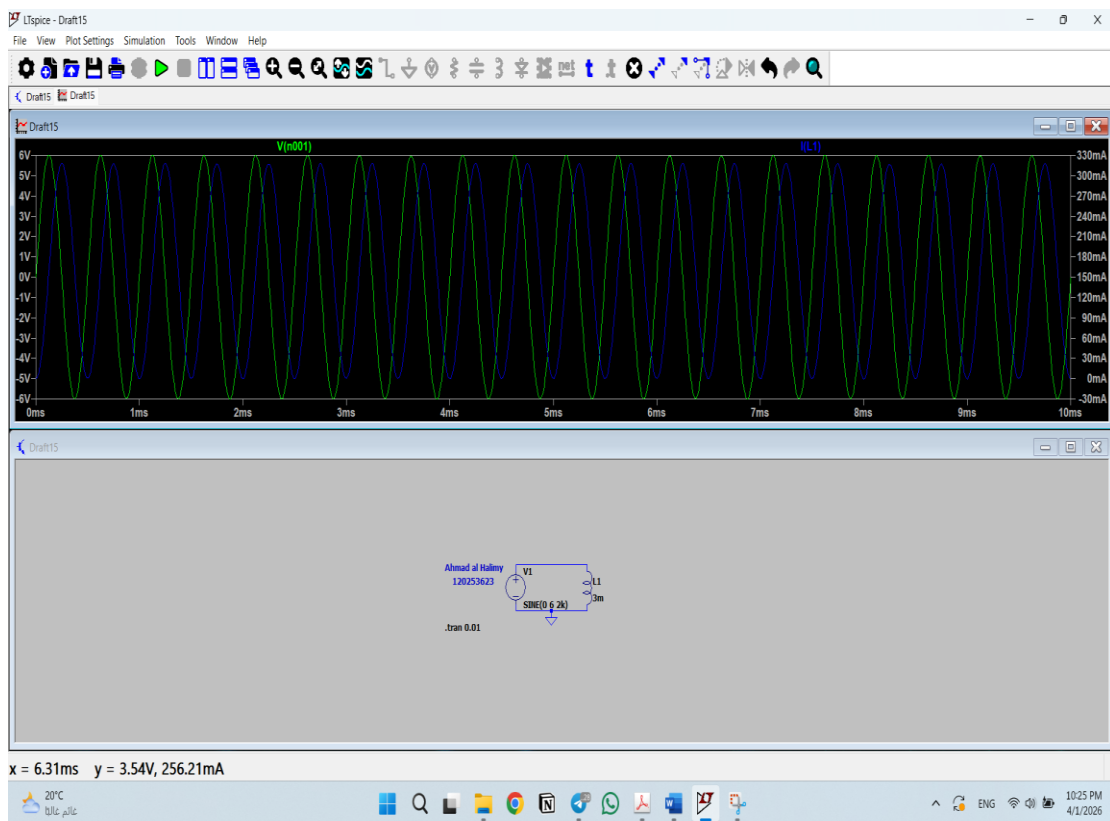
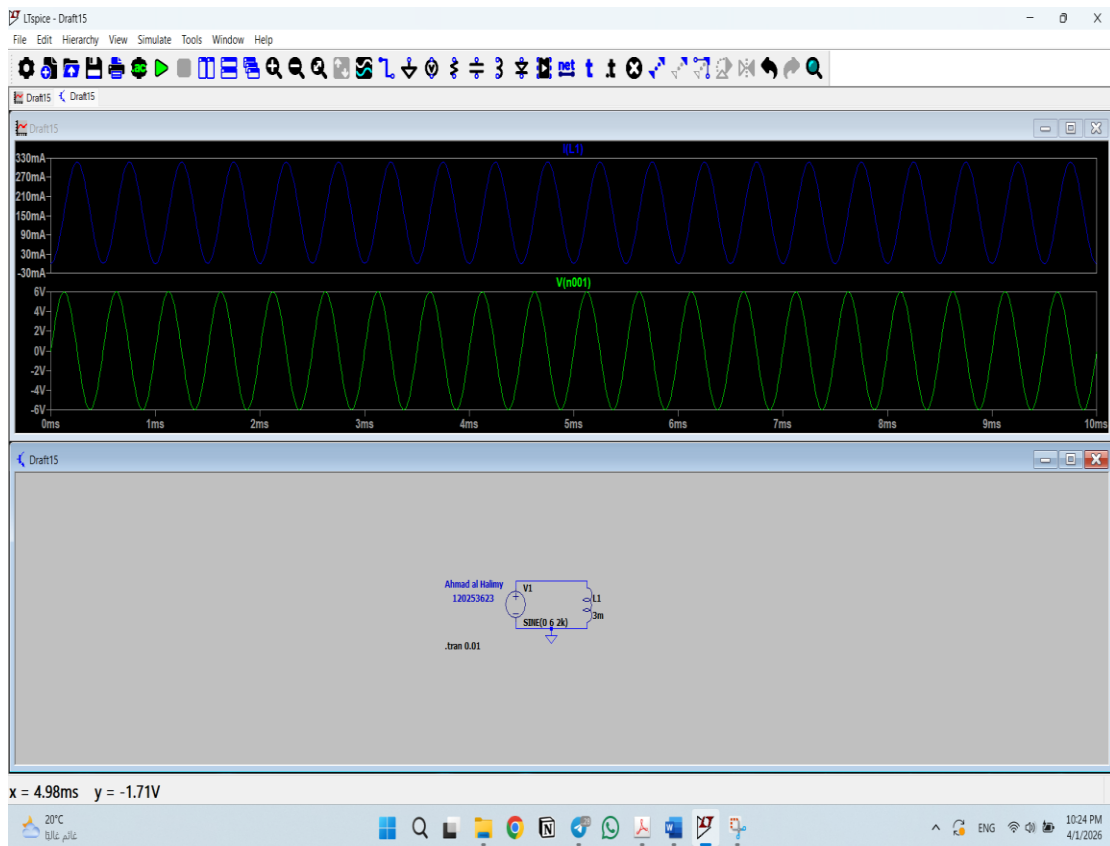




- Conclusion: the Current and Voltage in phase

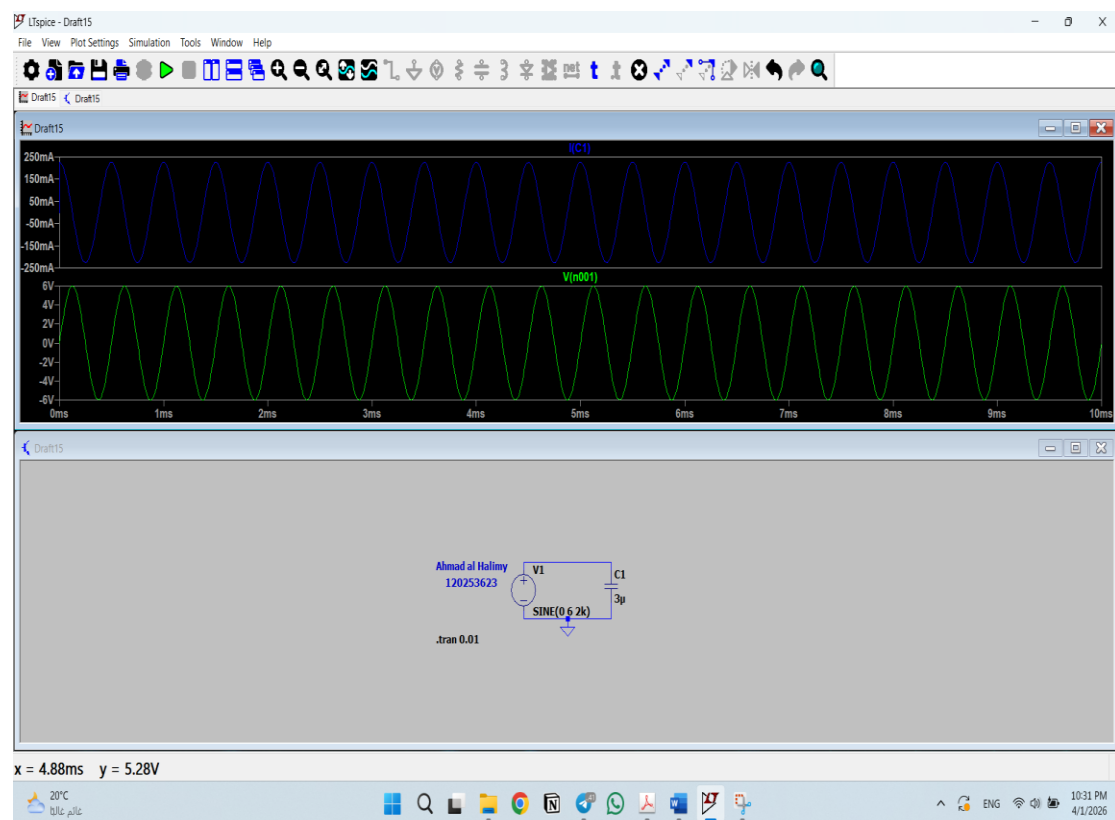
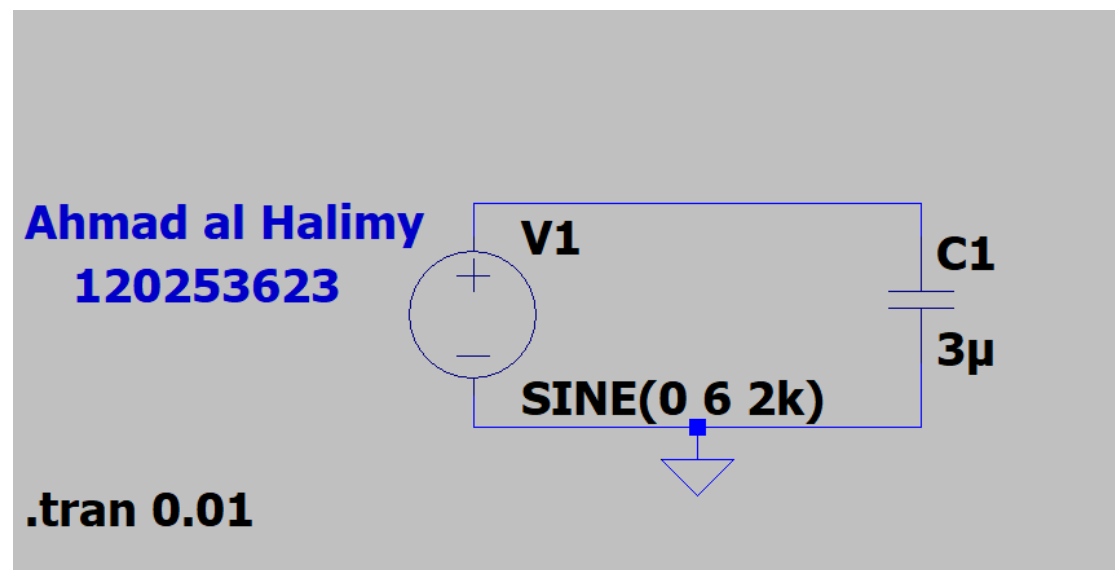
Circuit (2)

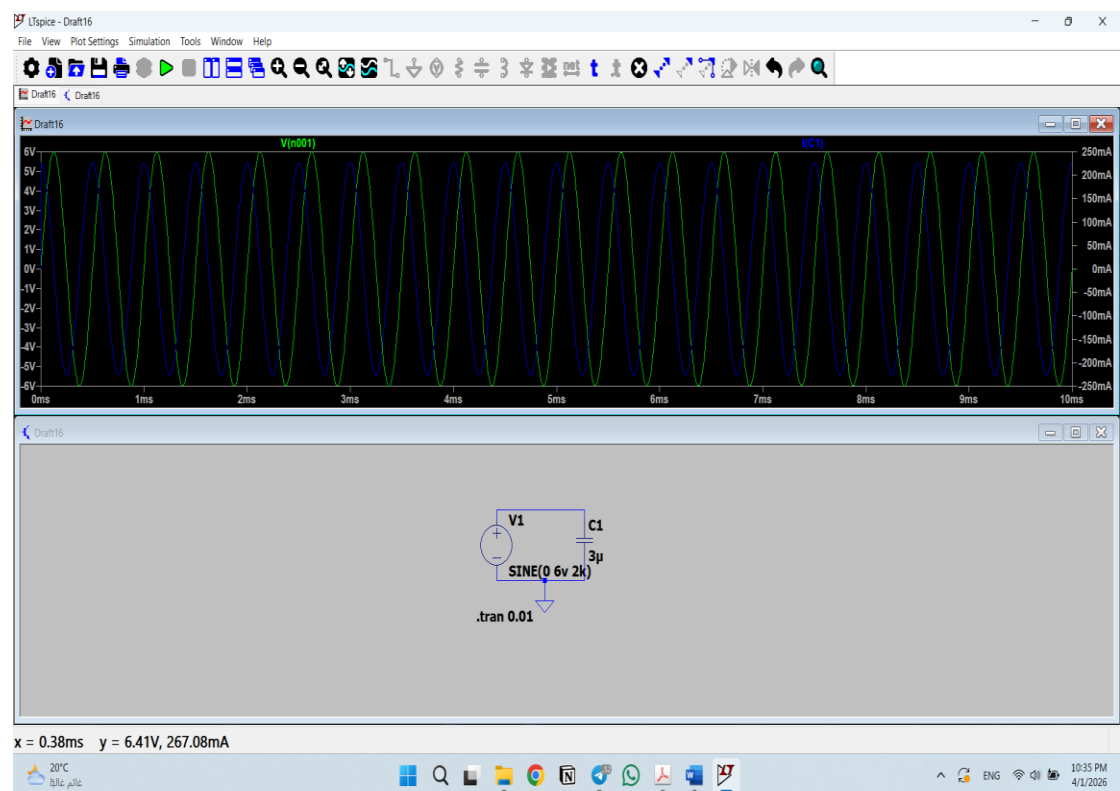




- Conclusion: the Current lags Voltage by 90°

Circuit (3)





- Conclusion: the Current leads Voltage by 90°