FACULATY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

ENEE 2101

Circuits Laboratory

Experiment.8 Prelab

Impedance and sinusoidal steady state

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November 7, 2024

Part A: Impedance Measurement

exp 8

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[1] $Z_R = 1K\Omega$ "Constant at any frequency

[2] $Z_C = \frac{1}{j\omega C}$, $\omega = 2\pi f$, $C = 1\times10^{-6}$

at $f = 250Hz \rightarrow Z_C = -j\frac{1}{2\pi(250)(10^{-6})} \Rightarrow Z_C = -636.94j\Omega$

at $f = 500Hz \rightarrow Z_C = -j\frac{1}{2\pi(500)(10^{-6})} \Rightarrow Z_C = -318.47j\Omega$

at $f = 1000Hz \rightarrow Z_C = -j\frac{1}{2\pi(1000)(10^{-6})} \Rightarrow Z_C = -159.24j\Omega$

at $f = 2000Hz \rightarrow Z_C = -j\frac{1}{2\pi(2000)(10^{-6})} \Rightarrow Z_C = -79.62j\Omega$

[3] $Z_L = j\omega L$, $\omega = 2\pi f$, $L = 100\times10^{-3} = 0.1$

at $f = 250Hz \rightarrow Z_L = j(2\pi)(250)(0.1) \Rightarrow Z_L = 157j\Omega$

at $f = 500Hz \rightarrow Z_L = j(2\pi)(500)(0.1) \Rightarrow Z_L = 314j\Omega$

at $f = 1000Hz \rightarrow Z_L = j(2\pi)(1000)(0.1) \Rightarrow Z_L = 628j\Omega$

at $f = 2000Hz \rightarrow Z_L = j(2\pi)(2000)(0.1) \Rightarrow Z_L = 1256j\Omega$

[4] $Z_{RC} = \sqrt{Z_R^2 + Z_C^2}$, $Z_R = 100\Omega$ at any frequency

at $f = 250Hz \rightarrow Z_{RC} = \sqrt{(100)^2 + (636.94)^2} \Rightarrow Z_{RC} = 644.7\Omega$

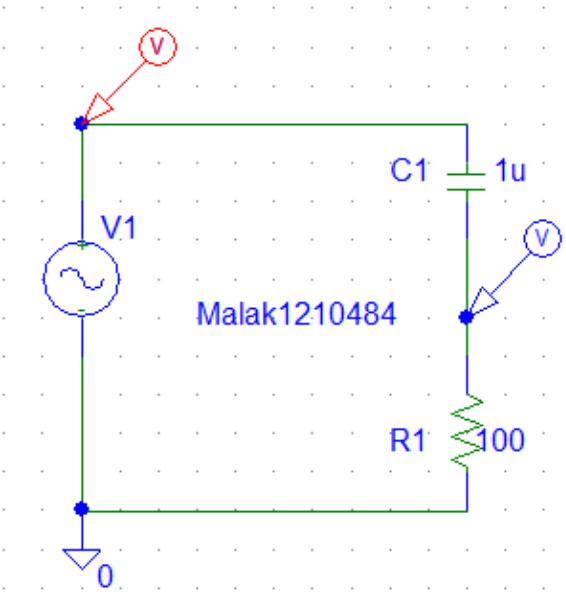
at $f = 500Hz \rightarrow Z_{RC} = \sqrt{(100)^2 + (318.47)^2} \Rightarrow Z_{RC} = 333.8\Omega$

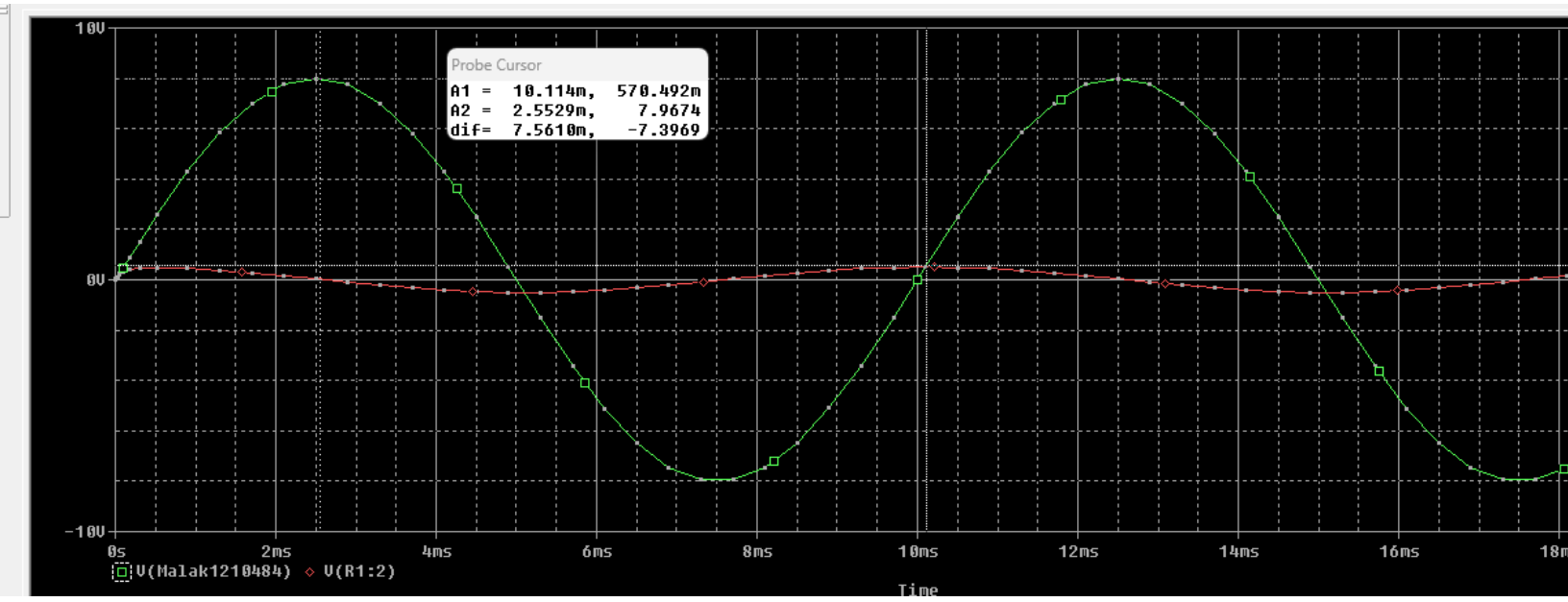
at $f = 1000Hz \rightarrow Z_{RC} = \sqrt{(100)^2 + (159.24)^2} \Rightarrow Z_{RC} = 188\Omega$

at $f = 2000Hz \rightarrow Z_{RC} = \sqrt{(100)^2 + (79.62)^2} \Rightarrow Z_{RC} = 127.82\Omega$

Part B: Phase Measurement

a)



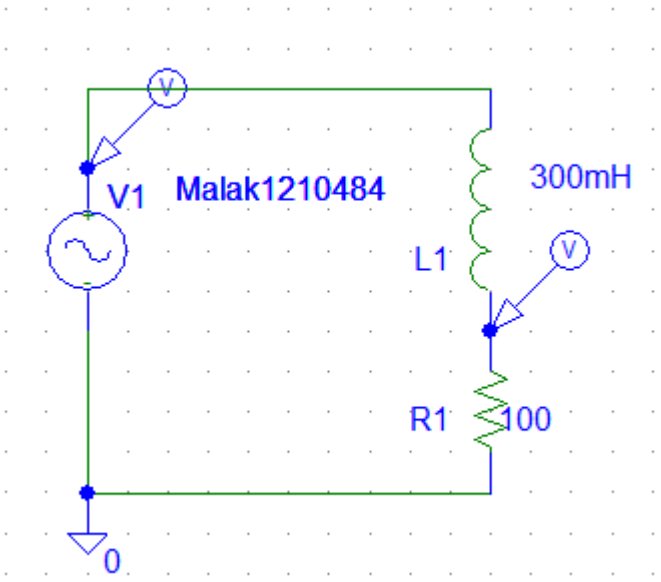


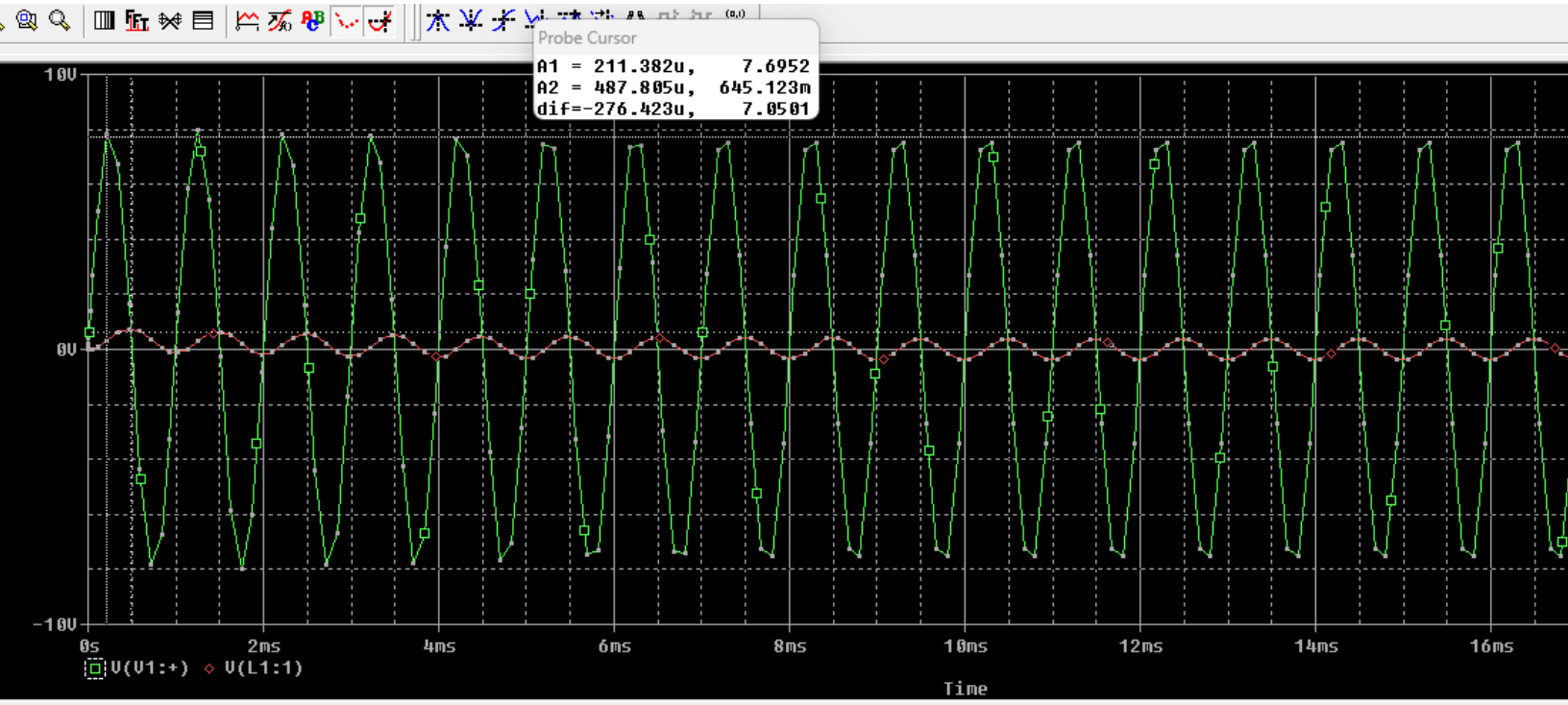
A1 for the Red Waveform, A2 for the Green Waveform.

$\Delta t = (10.114-2.5529)\ ms = 7.5611ms$

$\theta = 360 * f * \Delta t = 360 * 100 * 7.5611 * 10{-}3 = 272.2°$

b)





A1 for the Green Waveform, A2 for the Red Waveform.

Δt = (487.805-211.382) ms=276.423ms

$\theta = 360 * f * \Delta t = 360 * 1000 * 276.423 * 10{-}3 = 99.51°$