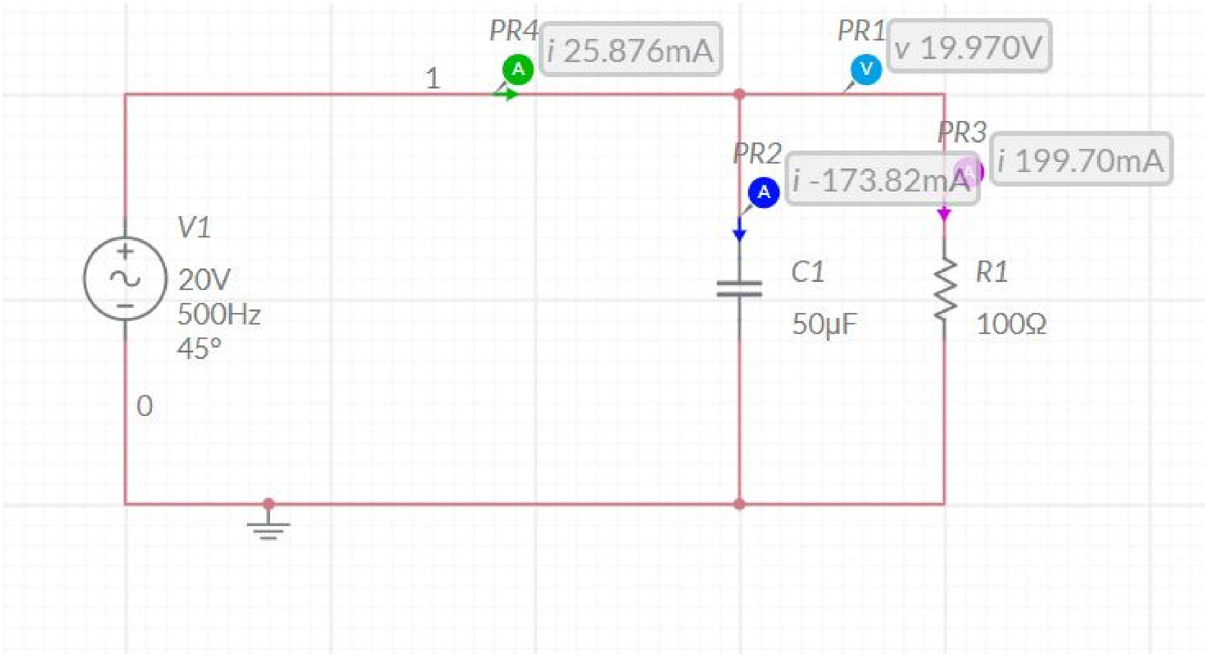
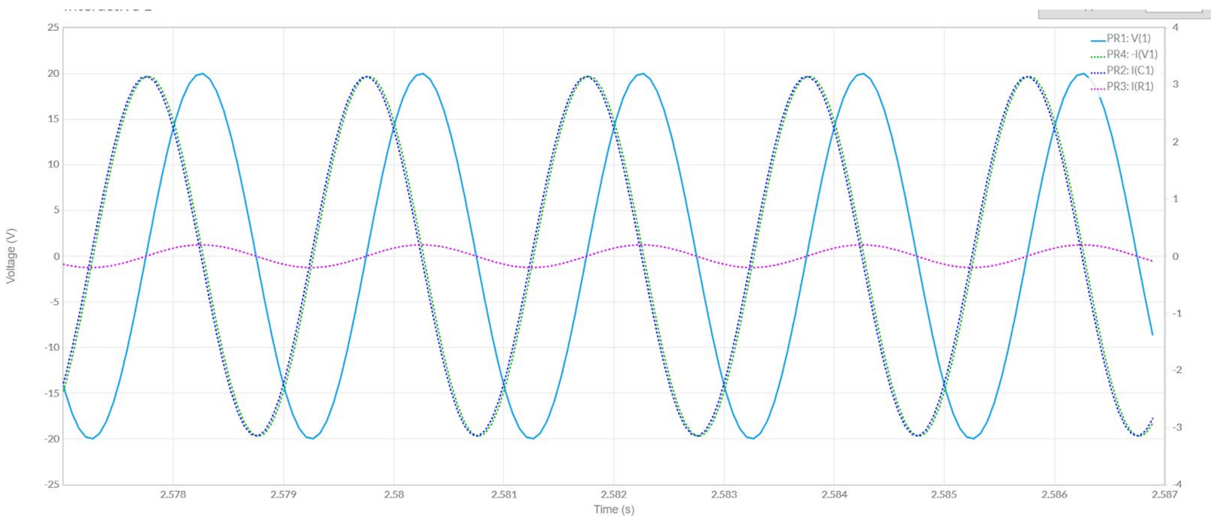
CSU11031 Electronics Assignment

Róisín Ní Bhriain
18326577

1.





(i)

The supply voltage and the capacitor current are out of phase by 90 degrees.The maximum voltage is 20V and the maximum current is 3.1573A throughout the circuit. The minimum voltage is -20V and the minimum current is -3.1476A. Both of these have sinusoidal output due to the AC current.

(ii)

<u>Current through the Capacitor</u>

$I = C\frac{dv}{dt}$

$I = \frac{50F\,d(20sin(1000t+\frac{\pi}{4}))}{dt}$

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I = 50(10^{-6})(20)(1000)cos(1000 t+ $\frac{}{4}$)

I = 50(10^{-6})(20000 cos(1000 t+ $\frac{}{4}$))

I = cos(1000 t + $\frac{}{4}$)A

The supply voltage is 90 degrees out of phase with the capacitor as the capacitor must lose some of its excess electrons to maintain a constant voltage as before, and starts to discharge itself until the supply voltage reaches zero again and the charging and discharging starts again. In a purely capacitive circuit, the voltage lags the current by 90 degrees.

(iii)

Total Current

I = $\frac{V}{R}$

R_{Total} = 100Ω

V_{Total} = 20 sin(1000 t + $\frac{}{4}$)

I = $\frac{20sin(1000t+\frac{}{4})}{100}$ - Current through the resistor

I_{Total} = $\frac{2sin(1000t+\frac{}{4})}{10}$ + cos(1000 t + $\frac{}{4}$)A - Total Current

Example

On the graph (713.77ms, 3.1463A)

i(713.77) = $\frac{2sin(713.77+\frac{}{4})}{10}$ + cos(713.77 + $\frac{}{4}$)A

i(713.77) = 0.0125581039 + 3.13539343812

i(713.77) = 3.14795154202A

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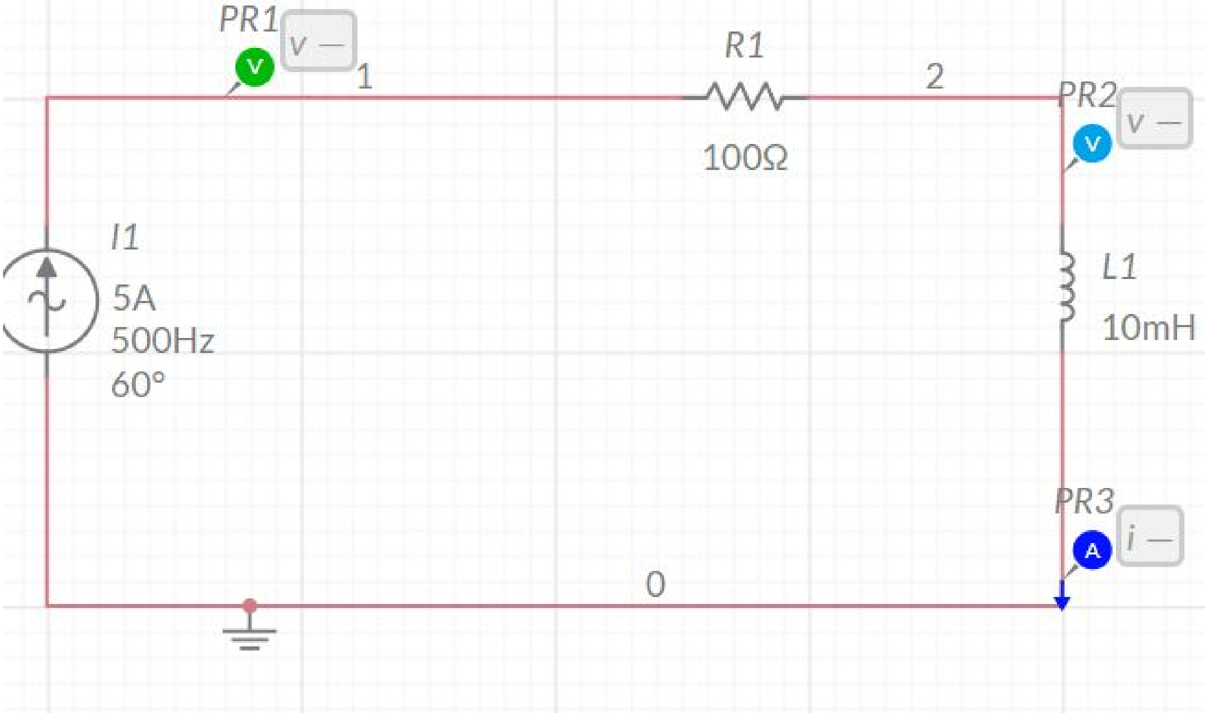

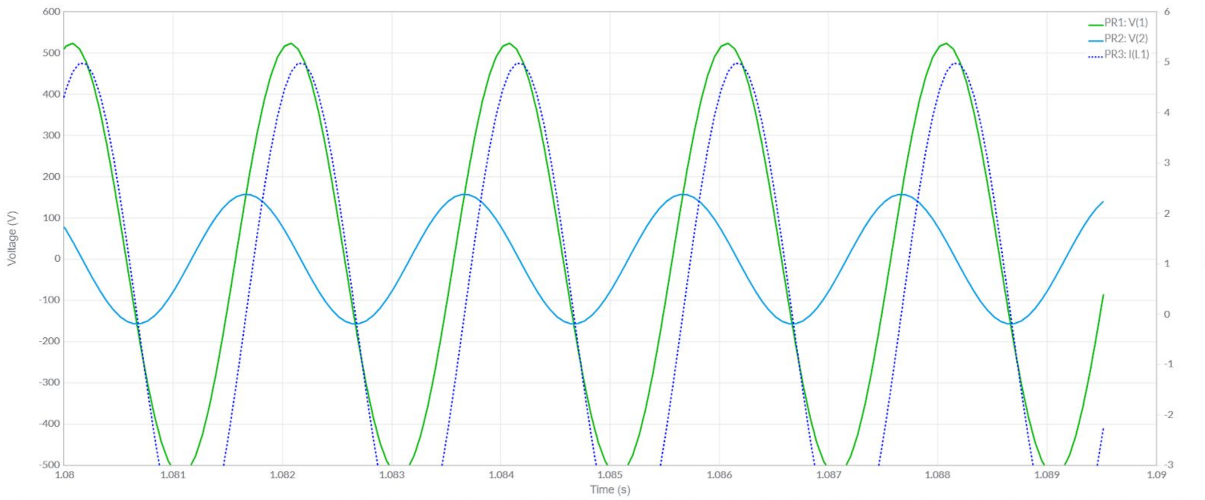

2.

(i)

<u>Voltage across the inductor</u>

v(t) = L $\frac{di(t)}{dt}$

v(t) = 10mH(d(5sin(1000πt+ $\frac{}{3}$)))

v(t) = 10mH5000π(cos(1000πt+ $\frac{}{3}$))

v(t) = 10(10^{-3})(5000π(cos(1000πt+ $\frac{}{3}$)))

v(t) = 50πcos(1000πt+ $\frac{}{3}$)V

In a purely inductive AC circuit the current lags the applied voltage by 90 degrees or ($\frac{}{2}$ radians).This is due to the inductive reactance which is the property in an AC circuit which opposes the change in the current.

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(ii)

$V = IR$

<u>Voltage through the resistor</u>

$100\ (5\sin(1000 + \frac{}{3}))$

<u>Total Voltage</u>

$v(t) = 50\ \cos(1000\ t + \frac{}{3}) + 100(5\sin(1000\ t + \frac{}{3}))$

$v(t) = 50\ \cos(1000\ t + \frac{}{3}) + 500\sin(1000\ t + \frac{}{3})V$

<u>Example</u>

On the graph PR1 = (48.080ms, 524.06V)

$v(48.08) = 50\ \cos(\ (0.04808) + \frac{}{3}) + 500\sin((0.04808) + \frac{}{3})$

$= 57.17582714 + 465.7009159$

$= 522.876743V$ which is approximately 524.06Vs