CPE 1150

Lab Number: 2

Ohm’s Law

and

R,L,C Elements

Team member:

Bruce Liu

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Conclusion:

Phase shift measurements are out of theoretical range. I attempted to repeat the experiment in my home lab and the phase shift measurement is bouncy with extreme ranges. I have a concern that my metal table might be messing with the measurement, but I am uncertain.

The resistance study is concerning since we are losing 100 ohms of data. compared to the measured value. There was no phase shift in this circuit. There is no effect of frequency on this circuit.

The capacitor circuit is unreliable in lower frequencies. But a 1/x formula approaches the origin of the graph as the value of x increases so I argue that the 2π is an insufficient scalar for this application. The waveform of V­r3­ leads the waveform of V­c1­.

Conversely, the measured impedance values taper off in the inductor likely in a √ x fashion so the formula for inductors is unreliable in higher frequencies. The V­L1­ leads the V­r4­.

Conversely, the capacitor circuit is unreliable in lower frequencies. But a 1/x formula approaches the origin of the graph as the value of x increases so I argue that the 2π is an insufficient scalar for this application.

Initial values table

|  |  |  |
| --- | --- | --- |
| Element list: | Intended impedance | Measured impedance |
| 10 Ω resistor | 10Ω | 10.1Ω |
| 620 Ω resitor | 620Ω | 629Ω |
| 33 nF capacitor | 33nF | 34.7nF |
| 15 mH inductor | 15mH | 13.67mH |

Resistance circuit:

Resistance experiment in AC voltage variable frequency:

There is no expected change in impedance in relation to frequency from the prelab which is R = V<θ/I<θ

Table 1:

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency (kHz) | ­ Measured V­­R1­­(V) | Measured V­­R2­­­(mV) | Impedance from calculated measurements  ­­­R­­­1 ­­= V­­r1 x R­­­2/V­­R2 (Ω) |
| 4 | 2.88 | 56.00 | 519.4285 |
| 6 | 2.88 | 58.00 | 501.5172 |
| 8 | 2.88 | 56.00 | 519.4285 |
| 10 | 2.88 | 58.00 | 501.5172 |

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RC circuit:

Table 2:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Frequency (kHz) | Measured V­­­Xc­­(V) | Measured V­r3­­(mV) | Predicted impedance X­c­(Ω) | Predicted value with measured capacitance  X­c(Ω) | Impedance from calculated measurements  X­c ­­= Vc1 \* R3/Vr3 (Ω) |
| 4 | 3.04 | 40.0 | 1205.7192 | 1146.6494 | 767.6 |
| 5 | 3.04 | 48.0 | 964.5754 | 917.3195 | 639.6666 |
| 6 | 3.04 | 52.0 | 803.8128 | 764.4329 | 590.4615 |
| 7 | 3.04 | 64.0 | 688.9824 | 655.2282 | 479.75 |
| 8 | 3.04 | 66.0 | 602.8596 | 573.3247 | 465.2121 |
| 9 | 3.04 | 74.0 | 535.8752 | 509.6219 | 414.9189 |
| 10 | 3.04 | 78.0 | 482.2877 | 458.6597 | 393.6410 |

Diagram

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RL circuit:

Table 3:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Frequency (kHz) | Measured V­­­L1­(V) | Measured ­­V­R4(mV) | X­­L ­= V­L1­\* R­4­/V­r4­­(Ω) | Measured inductor calculation  2π\*f\*L(Ω) | Theoretical values  calculation  2π\*f\*L(Ω) |
| 3 | 2.96 | 120 | 255.8666 | 257.6734 | 282.7433 |
| 4 | 3.04 | 96.0 | 319.8333 | 343.5645 | 376.9911 |
| 5 | 3.04 | 80.0 | 383.8 | 429.4557 | 471.2388 |
| 6 | 3.04 | 68.0 | 451.5294 | 515.346 | 565.4866 |
| 7 | 3.04 | 64.0 | 479.75 | 601.238 | 659.7344 |
| 8 | 3.04 | 56.0 | 548.2857 | 687.1291 | 753.9822 |
| 9 | 3.04 | 56.0 | 548.2857 | 773.0202 | 848.2300 |

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prelab:

resistance

V = I R

V/I = R

capacitor

V<θ /I<θ = Xc

X­c ­=1/2π\*C\*f

inductor

V<θ /I<θ = Xl

X­L­ = 2π \*f\*L

graphs included in the report