Name: Wang Zihao

Student number: A0204706M

Week 6 Studio 1

Group 4b

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**Activity #1: Understanding why we cannot ignore phase differences in AC circuits**

|  |  |
| --- | --- |
| VS,rms | 5.00V |
| VR,rms | 3.86V |
| VL,rms | 1.89V |

VS,rms = 5.00V

VR,rms + VL,rms = 3.86 + 1.89 = 5.75V

Since VS,rms is different from VR,rms + VL,rms, KVL cannot be applied on RMS voltage values. This is because of there is phase difference, and there is only a specific time t when we can apply KVL.

**Activity #2: Performing voltage phasor measurements using oscilloscope, and verifying KVL**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | RMS value from Activity #1 (V) | Amplitude (V) | Measured ΔT (μs) | Calculated phase angle | Phasor (Amplitude ∠Phase Angle) |
| VS | 5.00 | 7.07 | / | 0° | 7.07∠0° |
| VR | 3.90 | 5.52 | 7.00 | -25.3° | 5.52∠-25.3° |
| VL | 1.89 | 2.67 | -12.20 | 44.1° | 2.67∠44.1° |

VR is leading and VL is lagging

3.

Phasor: VS = 7.07∠0°

Phasor: VR + VL = 2.67∠44.1° + 5.52∠-25.3°

= 2.67cos44.1 + (2.67sin44.1)j + 5.52cos-25.3 + (5.52sin-25.3)j

= 6.91 - 0.5j =

Percentage difference of amplitude ≈ ≈ 1.84%

Phasor VS is approximately equal to VR + VL with a percentage difference of amplitude of 1.84% which is small., and there is a small difference of the phase angle of -4.14. Thus KVL can be applied in terms of phasors.

4.

VL = 2.67cos44.1 + (2.67sin44.1)j

5.

RL = 13.77Ω

ZL = RL + jωL = 13.77 + (2π 10 103 820 10-6)j = 13.77 + 51.52j

6.

R = 99.29Ω

ZR = R = 99.29

7.

VR = 7.07∠0° = = 5.65∠-24.5°

VL = 7.07∠0° = 7.07∠0° = = 3.03∠50.5°

8.

The phasor for the resistor’s voltage is VR is close with the phasor VR obtained while the phasor for the practical inductor’s voltage VL has significant different with the phasor VL obtained. One source of error could be the inductance of the inductor may not be exactly equal to 820μH which we used for calculation.