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| **To: Professor Darish** | **Date: 4/07/2015** |
| **From: Trever Wagenhals** | **Course & Section Number:** |
| **Subject: Power Analysis in AC Circuits** | **Partner(s):**  **TA:** |

**SUMMARY**

**EXPERIMENTAL APPROACH**

**Equipment and Materials**

* Oscilloscope
* Function Generator
* Protoboard
* Inductors, resistors, and capacitors
* Banana clips, BNC cables, probes
* Power supply

**Procedure**

This experiment involved calculating complex power through different measurements. Calculating voltage drop and current across a resistor allowed the active power to be calculated at each resistor. Taking the conjugate of the current and the effective current, the reactive power could then be calculated across each inductor and capacitor. Adding the active powers and reactive powers up and combining them will give the complex power S, throughout the circuit.

**DISCUSSION OF RESULTS**



Calculating I2 and I3 equivalent by either nodal analysis or simply combining the parallel circuit, I1 can be calculated. Once I1 is calculated I2 and I3 can then be calculated by just doing current division across each branch. Once all there currents were calculated, the voltage drop across each material could be calculated by ohms laws. Power at each material can finally be calculated by the complex power rules.

Table 6.1.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Calculations** | | | **Measurements** | | |
| Phasor | | RMS-  value | Phasor | | RMS-  value |
| Rectangular | Polar | Rectangular | Polar |
| I1 | .20478 – j.13674 A | .246<-33.73 A | .174<-33.73 A | .206 – j.13596 A | .246822<-33.42 A | .1744<-33.42 A |
| I2 | .178 – j.0920 | .2006<27.31 A | .141<27.31 A | *No data are needed*  *in this cell* | |  |
| I3 | .0343 –j.8485 | .8492<-87.68 A | .600<-87.68 A |  |

After the currents have been calculated, plugging them into the equations below allow for the active and reactive powers to be calculated. In order to ensure that the procedure was done properly, the equation for the source power and the equation for the summation of the power should cancel out to equal 0. When comparing the results, there was minimal error to conclude that the data was accurate. The error in data can easily be complimented to the internal impedance and resistance of the equipment used to take all the measurements.

Table 6.2.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | **Calculations** | | **Measurements** | |
| Power generated by source | , mVA | Active | Reactive | Active | Reactive |
| 511.95 mW | -j341.85 mVAR | 515.05 | -j339.9 |
| Active power consumed by circuit | , mW ………….  , mW …………  , mW …………. | 171 mW  238 mW  117.6 mW | | 168.9 mW  244.04 mW  103.67 mW | |
| , mW | 526.6 mW | | 516.61 mW | |
| Reactive power consumed by circuit | , mVAR.……  , mVAR.……  , mVAR.…… | 173 mVAR  -505 mVAR  -8.38 mVAR | | 169.7 mVAR  -502 mVAR  -9.8 mVAR | |
| , mVAR | -340.38 mVAR | | -342.1 mVAR | |

***Questions***

4.1. Why don’t we need to get additional information about the phase of the branch currents for evaluating the power in the discrete components? (By using Fluke meter we are measuring only the effective (RMS) values of currents in those components.)

The phase of the current is not needed in the calculation of the reactive or the active power, so by just determining the effective current, both powers can be calculated, regardless of the phase that the current is at.

4.2. Explain the physical meaning of the principle of conservation of power in AC-circuits.

Because power cannot be created nor destroyed, just like the components that make it up, then if the individuals powers of components that make up a circuit are found, then the complex power is simply the combination of all of the powers.