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ELEN 50L – 47347
F: 2:15 - 5:00 pm
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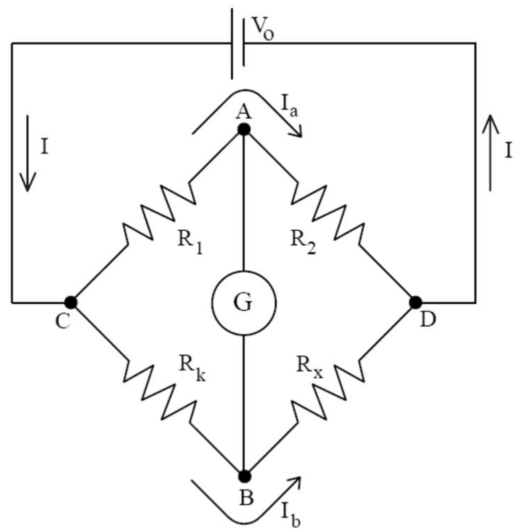
Lab #3: Wheatstone Bridge

1. Objectives

a. Define the variable components of Wheatstone bridge.
b. Describe how the Wheatstone bridge works.

2. Laboratory Procedure



Step 1: Build the circuit above.

Step 2: Use a decade resistance box for R_k and you will be provided with a resistor of unknown value, R_x.

Step 3:

R1 = 1.4247kOhm, R2 = 11.936 kΩ

When $V_{AB} = 0$, $R_k = 2.684$ kΩ

The value of the "unknown" resistor $R_x = 22.486$kΩ

Step 4: Measuring with a DMM, $R_x =$ 21.481kΩ

Step 5: Compare the calculated value and measured value of R_x.

The measured value of Rx and the calculated value of Rx are off by 4.679 %. This is a pretty close measurement.

Step 6: Get another R_x which has the same theoretical resistance and repeat steps 3-4.

When $V_{AB} = 0$, $R_k = 2.683k\Omega$

The value of the "unknown" resistor $R_x = 22.478k\Omega$

Measuring with a DMM, $R_x = 21.480k\Omega$

Step 7: Compare the calculated value and measured value of $R_{x.}$

The measured value of Rx and the calculated value of Rx are off by 4.646%. This is another pretty close measurement.

Step 8: Compare the values from steps 5 and 7.

Both measurements are pretty similar.

Step 9: Calculate the total power delivered by the voltage source and the power absorbed by each resistor.

$P_v = IV_0 = (1.1623mA)(10V) = 0.011623W$

$P_{R1} = (I_1)^2*R_1 = (0.76mA)^2*(1.4247k\Omega) = 8.229*10^{-4}W$

$P_{R2} = (I_2)^2*R_2 = (0.76mA)^2*(11.936k\Omega) = 6.894*10^{-3}W$

$P_{Rk} = (I_k)^2*R_k = (0.39mA)^2*(2.683k\Omega) = 4.081*10^{-4}W$

$P_{Rx} = (I_x)^2*R_x = (0.39mA)^2*(21.480k\Omega) = 3.267*10^{-3}W$

Total power absorbed = 0.01139 W

Total power generated = 0.011623 W

Total power absorbed is equal to total power generated! :D

3. Observation and Analysis

Through the lab, we learned that we cannot measure resistance while the resistor is inside the circuit. When we measured the mystery resistor inside the circuit, we got around 9 kΩ, even though the resistor itself was supposed to be about 22kΩ. Furthermore, the calculations of Rx generated from the lab were pretty close to the measured values of Rx, so the lab went smoothly.

4. Questions

Questions from the lab are answered in the procedural section of the lab.

5. Conclusions

Through this lab, we were able to learn about the Wheatstone bridge circuit, and be able to generate theoretical values for various resistances and currents. Furthermore, we used a variable resistor box for the first time, and it was pretty interesting to use. Although the lab itself was very simple, the calculations for power took awhile to generate. Overall, this lab helped us gain more knowledge about electric circuits.