Lab 4: Resistivity of Nickel Chromium Wire and Use of the Wheatstone Bridge Circuit

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1 Purpose

In this lab, we measured the resistance of a nickel chromium wire and calculated the resistivity ρ. We then built a Wheatstone bridge to find the resistances of individual capacitors.

2 Theory

Using nickel chromium wire ($80\%\ Ni - 20\%\ Cr$), we will apply the equations for calculating resistivity ρ.

For a given wire resistivity ρ, length L, and cross-sectional area A, the resistance R, is given by:

$$R = \frac{\rho L}{A}$$

Solving for ρ, the above equation is re-written as:

$$\rho = \frac{RA}{L}$$

Verifying the untis for ρ:

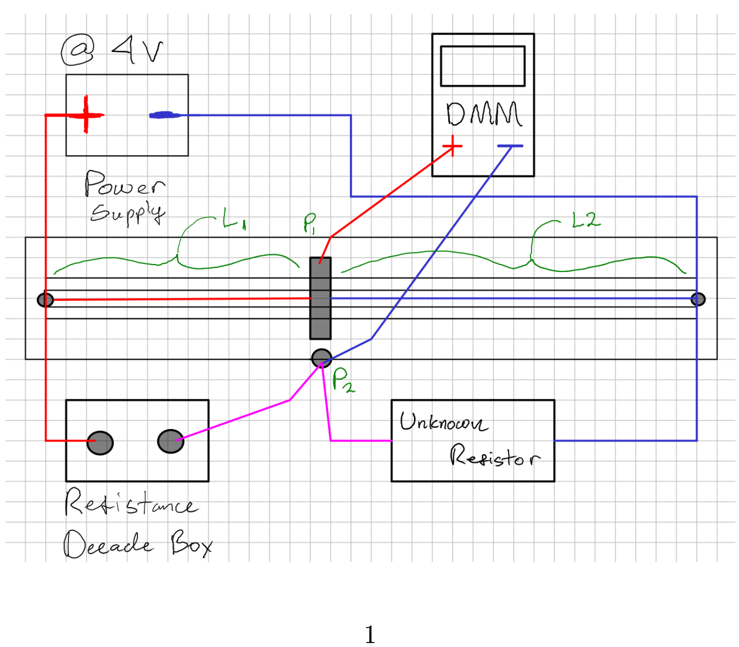
$$\rho = \frac{\Omega m^2}{m} = \Omega m$$

3 Experiment Analysis

4 Procedure

For the first part of the lab, we first took six measurments of diameter of the nichrome wire (mounted on a bridge-board) using calipers, two measurments per group member. Using the data, we then calculated cross-sectional area of the wire (πr^2) and resistivity ($\rho = \frac{RA}{L}$), where R is the resistance (Ω) of the wire measured with a digital multimeter, A is the cross-sectional area, and l is the length of the wire. The resistivity we found was compared to the given range of resistivity of a nichrome wire: ($1.10 * 10^{-6}\ \Omega m\ to\ 1.50 * 10^{-6}\ \Omega m$).

For the second part of the lab, we put together a wheatstone bridge circuit using the nichrome wire bridge-board, a power supply, a digital multimeter, a decade resistance box, six unique resistors (tested one at a time), and alligator clips. A diagram of the circuit is shown below:



The digital multimeter's ground probe is afixed to a conductive screw on the edge of the bridge-board P_2. The positive probe of the multimeter is free to move along the length of the wire to find the where $V = 0$, giving us lengths L_1 and L_2. Since the resistances of the decade box and the unknown resistor are proportional to L_1 and L_2 respectively, we can find the the value of the unknown resistance using:

$$R_u = \frac{R_k L_2}{L_1}$$

Where R_u is the unknown resistance and R_k is the known resistance of the decade box.

5 Data and Graphs

5.1 Part 1

5.2 Part 2

5.3 Part 3

6 Results

7 Questions

7.1 Part 1

7.2 Part 2

7.3 Part 3

7.4 Part 4

8 Conclusion