Yijiang, Yao

Instructor Si, Li

ECE 110

2 April 2024

Unit Report 1

Topic 1: The Resistor Network

Case 1: A series resistor network with resistors R1, R2, R3, … and so on. The equivalent resistance for resistors in series is the sum of all the resistances

Case 2: The resistor network contains resistors in parallel, the calculation is :

Experiment2: use 100 Ω for each resistor.

图示, 示意图

描述已自动生成

|  |  |  |
| --- | --- | --- |
| Number of resistors | Resistance (measured in Ω) | Theoretical Value (measured in Ω) |
| 10 | 10.10 | 10.00 |
| 9 | 11.19 | 11.11 |
| 8 | 12.57 | 12.50 |
| 7 | 14.32 | 14.28 |
| 6 | 16.69 | 16.67 |
| 5 | 19.9 | 20 |

Table1: left-side resistor network decomposition

For the rated power, we know that

Topic 2: The efficiency, 𝜂, of the Resistor Network for Speed Control circuit.

According to data from experiment 2 :

I believe that most of the energy wasted is transformed into heat.

Topic 3; The agreement of actual measurements taken to confirm Kirchhoff’s law

1 Kirchhoff’s Current Law (KCL): This law states that the total current entering a junction in a circuit must equal the total current leaving the junction. Mathematically, it can be expressed as

2 Kirchhoff’s Voltage Law (KVL): This law states that the sum of the electromotive forces (EMFs) in any closed loop of a circuit is equal to the sum of the potential drops within that loop. Mathematically, it can be expressed as

图示, 示意图

描述已自动生成

|  |  |
| --- | --- |
| symbol | Voltage/V |
| V1 | 2.66 |
| V2 | 4.90 |
| V3 | 7.55 |
| V4 | 2.51 |
| V5 | 5.05 |

Loop1

图示

描述已自动生成

V3=7.55V，V1+V2=7.56V, So, V1+V2≈v3

Loop2

图示

描述已自动生成

V3=7.55V，V4+V5=7.56V, So,V3≈V4+V5

Loop3

图示

描述已自动生成

V1+V2=7.56V，V3+V4=7.56V, So, V1+V2=V3+V4

图示

描述已自动生成

As measurements, I1=I2+I3

In conclusion, the Kirchoff’s laws are confirmed.

Topic 4: The use of the equipment

1 Ohmmeter

图示

描述已自动生成

Connect two poles and press the “Ω” button to measure with the power off.

2 Voltmeter

图示, 示意图

描述已自动生成

Press the “DC” button. It’s typically connected in parallel to the circuit element being measured.

3 Ammeter

图示

描述已自动生成

Press the “-I” button. It’s typically connected in series with the circuit element being measured.

4 Power supply

When using the Rigol power supply in the laboratory, we connect the two outputs of the power supply together and then connect them to the circuit requiring power. We need to set the voltage and maximum current values to make the power supply operational. We select the channel connected to the circuit. We set numerical values by pressing the buttons with numbers and set the maximum voltage by pressing the button next to the V symbol. We do the same but press the button next to the A symbol to set it to the maximum current. By default, the power supply is used as a voltage source, but it’s important to note that if the current in the circuit exceeds the maximum ampere, it will not be able to provide the full voltage.

When using a battery, we must be mindful that it has no ampere limit and is set to provide a constant 3.8 volts. When short-circuited, it may melt, causing significant trouble.

5 Battery

Provides electrical energy to a circuit. It can be used to deliver a specific voltage and current to circuits.

6 Oscilloscope

图形用户界面, 图示

描述已自动生成

An oscilloscope is a device used to measure changes in electrical signals over time.

1 Connection: You connect the BCD cable to the desired channel and parallel the cable ends with the component being measured.

2 Activation: Press the channel button for the desired channel to activate it.

3 Default settings: The oscilloscope defaults to Auto mode.

4 Time length adjustment: Use button 5 to adjust the display’s time length for a clear, non-shaky waveform.

5 Single mode: Use it when the waveform is discontinuous, such as in cloud detection.

6 Trigger value setting: Set a specific trigger value, and the machine records the waveform between the time the voltage rises above the trigger value and when it falls below it. Adjust the trigger value using the menu.

The oscilloscope is a measurement device that can capture the time history of a signal.

Topic 5: The modules

Module1:

Resistors are indispensable components in electronic devices, which can convert electrical energy into heat energy by precisely controlling the current. Its electrical conductivity depends on the resistivity of the material, which is closely related to factors such as the ease with which electrons can escape from the nucleus, the distance between atoms, and the temperature of the material. Resistors closely follow Ohm's law and have a variety of resistance values to choose from, and are widely used in electronic devices to protect circuits and devices from failures such as overload and short circuits.

Module2:

This module introduces ethical considerations in the field of engineering, particularly in the analysis of electronics and circuits. It highlights the importance of understanding how individual work fits into larger systems and highlights the need for ethical awareness. The module references the IEEE Code of Ethics for Engineers, a global guide to the conduct of engineers.

Module4:

Through the example operation, we learned how to use Python to draw the voltage and current relationship diagram. As a free and open-source programming tool, Python is gradually emerging in the field of scientific computing and data visualization.

I learned an alternative to MATLAB for plotting data via the matplotlib library for the Python programming language.

图表, 折线图

描述已自动生成图表, 直方图

描述已自动生成