Introductory Experiments and Linear Circuits I

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Abstract

In this lab, we explore —– BSC

1 Introduction

1.2

1.4

2 Keithley 2110 Digital Multimeter3 (DMM)

- uncertainty The range should be adjusted suitable range within — for each measurement , within order of magnitude. [1]

3 BSC Laboratory Breadboard Box

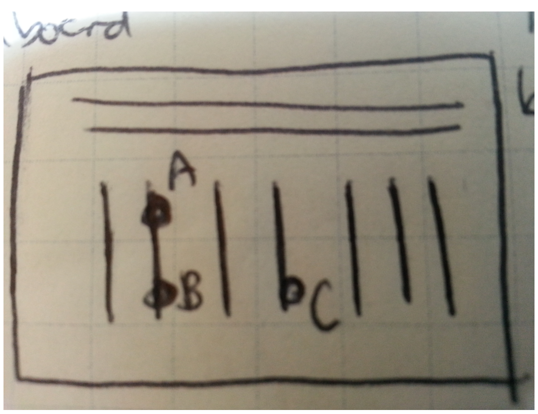


Figure 1: We put jumper wires connecting the A and B, B and C separately and measure the resistance across them.

[1] Too large a range will result in the error "OVLRD" (overload) and too low will cause —

1.1 The breadboard is a device suitable for rapid-protoyping circuits, without long chemical etching process of the PCB. As shown in Fig.1 , it is horizontally connected along the longer edge for the two top and bottom buses, which often serves as to input voltage and grounding –. We measured the resistance across A and B as 0.16 Ω and across B and C as “overload”. These result make sense because since B and C is not connected, the resistance is almost infinite, and is therefore not registered on the DMM. Likewise, since A and B are connected, there is minimal resistance between them.

1.3 The reading between the 12 output and the 5V supply ground fluctuates around 0V. The reason why —-.

1.5 Since the resistors are arranged in series as shown in Fig.2, the current through each resistor should be the same.

$$I = \frac{V}{R_{eq}} = \frac{V}{R_1 + R_2} = \frac{24V}{480 \times 10^3 \Omega} = 5/0 \times 10^{-5} A \tag{1}$$

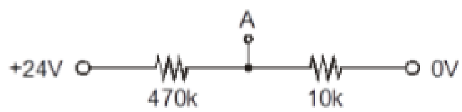
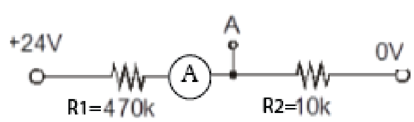


Figure 2: Voltage divider setup

1.7 a) Depending on the DMM setup, it can act as a voltmeter or ammeter. To meaaure the current through a 10kΩ resistor, we need to connect the DMM in parlalle with the 10kΩ resistor as shown in Fig. —- Then, using Ohm’s law we can compute the current flowing through the 10kΩ resistor:

$$I = \frac{V}{R} = \frac{0.510V}{10k\Omega} = 5.1 \times 10^-5A \tag{2}$$

which is approximately the same as predicted in 3. Alternatively, we can also connect the multimeter in series with the resistor as shown in Fig. 3 [2] to measure the current directly, and this yields the same current value as computed in Eq.2. b)



4 Digital Oscilloscope

voltage on the vertical axes and time on the horizontal axes

4.1 Tune-able Parameters and useful functions

- AC/DC Setting : (See Sec.6.1)
- Scale: Vertical and horizontal zoom in ; adjust accordingly to — window that best captures
- Measurement: useful quantities

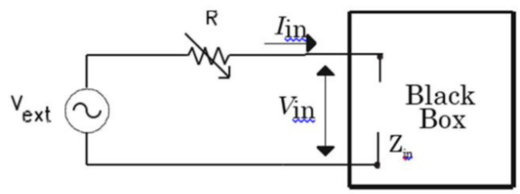
[2]Note that the —- terminate need to be plugged into the hole that —- and — instead of the — and —- as when we do the voltage measurement. The left 2 —- gives a better accuracy

5 Arbitrary Waveform Function Generator

6 Frequency and time measurements

6.1 AC measurement

7 Thevinin Equivalence



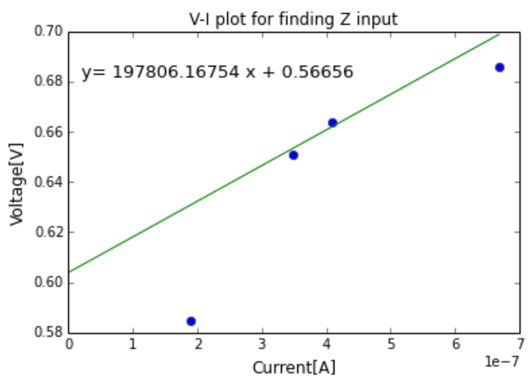


Figure 3: Voltage measurement has uncertainty of 0.001V .

2.3 We treat the oscilloscope as a black box of unknown impedance. We substituted different resistors in the circuit shown in Fig.7, and measured the input voltage. Using Eq.3 , we can compute the input current as plotted in Fig. 3

$$I_{in} = \frac{V_{ext} - Vin}{R} \tag{3}$$

A linear regression on the data results in a slope of 0.197806 MΩ. Since $Z_{in} = \frac{V_{in}}{V_{ext}-V_{in}}R = \frac{V_{in}}{I_{in}}$, the value of the slope is equivalent to the input impedance, which is the same order of magnitude as the input impedance of typical oscilloscope ($\approx$ 1 MΩ). [**?**]

8 Conclusion

9 Acknowledgments

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