ENEE 417 -Spring 2013

Design #3 Week #6 starting W 02/27/13

**Measuring Small Currents without the Application of Resistors**

In this experiment an op-amp current tracer will be designed, constructed, and tested; use the 1458 op-amp package and bias them with symmetric + & - voltages of about 15 volts each.

*Background:*

The primary objective of this lab is to design and test the circuit designed by Maciej Kokot's of Gdansk University of Technology in Poland. This circuit is used to measure small currents without using resistors.Kokot's design is revolutionary as there is no existing method in place to measure current without adjusting the circuit. Today's common methods for measuring current involve adding resistive components to the circuit. For example, one method involves using a resistor, in series with the current path, and then using a differential amplifier to measure the voltage drop. [1]

*Procedure:*

A. Review use of:
1. Tektronix 577-177-D1 commercial curve tracer
2. Curve tracing in PSpice

B. Design the circuit of Figure 1 below (which uses Kokot'scurrent measuring circuit [1]). We are looking for the current through resistor R7.
1. Construct the circuit using the same values. It is important when building the circuit that R8 and R4 sum up to half of R7. Similarly, R2 and R3 must equal R7. So, R7, R2, and R3 should be 10 ohms and R8 and R4 should be 5 ohms.
2. Using the LabVIEW oscilloscope, obtain a diagram displaying the voltage drop, where probes are shown in Figure 1. Use this value to calculate the current through R7.
3. Use LabVIEW to computer control the Tektronix oscilloscope and record a file on disk of the curves.
4. Include the curves in your report.

C.Design the circuit of Figure 2 (the conventional method for measuring current).
1. This will involve adding a second resistor in series with the test resistor. Use 1 ohm for the second resistor. Measure the voltage drop across the new resistor using a Voltmeter and calculate the current using ohms law. This value will not equal the current from Kokot's design.
2. Compare the two and explain the difference.

D. Repeat parts B and C using a 10K resistor for R7. What are the new values for current? Are these still different?
E. Investigate frequency response results.

*References:*

[1]:Kokot, Maciej. "Measure Small Currents without Adding Resistive Insertion Loss - 2011-07-28 07:00:00 | EDN." *EDN* 14 (2011): 52-54. Print

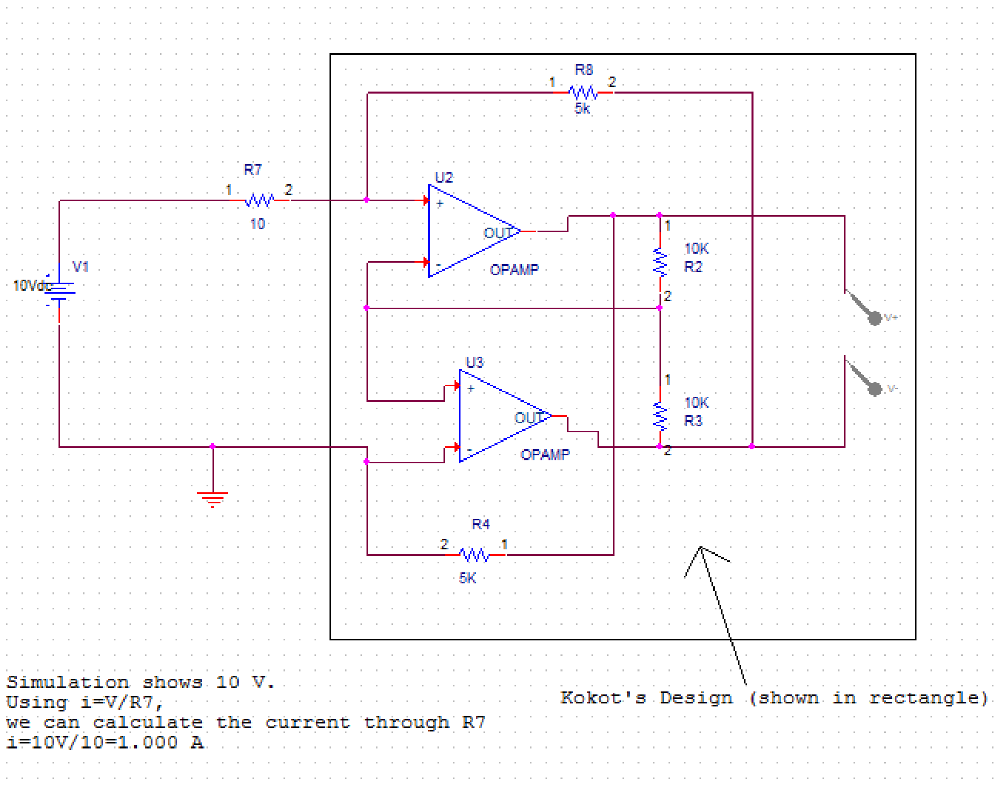


**Figure 1: Kokot's Design- Measuring current for R7 (Shown without bias)**

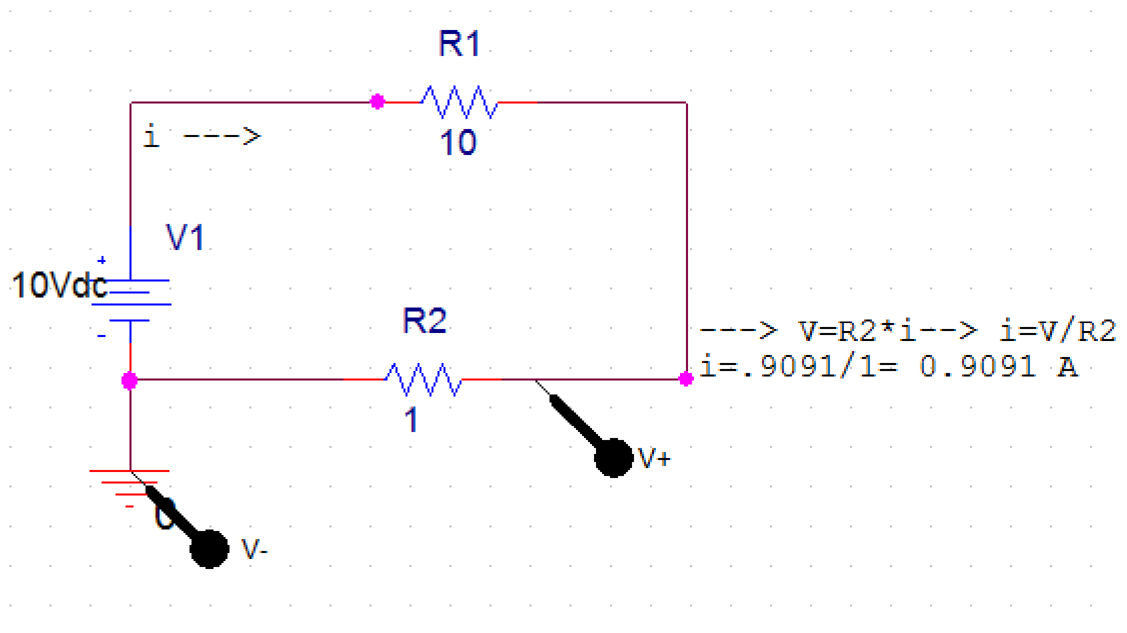


**Figure 2: Conventional Method (R1=original resistor)**