

ECE 109L - TRANSFER FUNCTIONS - LAB 23

LOADING IN RESISTOR CIRCUITS

FALL 2006

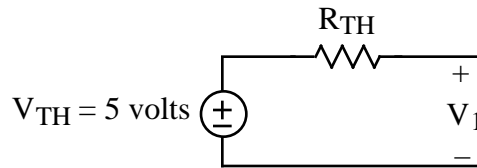
A.P. FELZER

OBJECTIVE

In the last lab we saw how output voltages and currents are related to the source. The objective of this lab is to see how output voltages and currents are affected by the value of the output resistor. Note that we refer to the output resistor as the *load* and its affect on the circuit as *loading*.

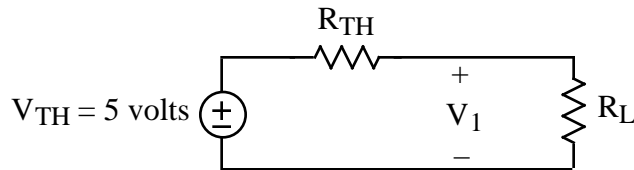
LAB

1. Given the following Thevenin Equivalent of a resistor circuit



PARTNER 1: $R_{TH} = 1K$ PARTNER 2: $R_{TH} = 2K$

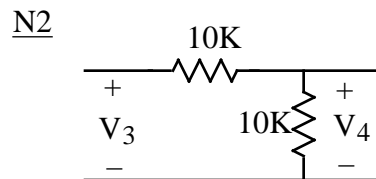
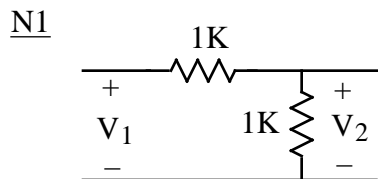
- a. Measure your resistor values. Compare with nominal values
- b. Measure V_1 for your circuit
- c. Now make use of a resistor box, potentiometer or individual resistors to measure V_1 in your circuit



for different values of the load R_L like 0, 1K, 2K, 4.7K, 10K, 15K, 20K, . . .

- d. Plot your data points from part (c). Then draw a curve through them. Describe what's going on in your circuit.
- e. What's the relationship between R_L and R_{TH} when the circuit is being loaded down by R_L - when the connecting of R_L causes a "significant" decrease in V_1
- f. What's the relationship between R_L and R_{TH} when the circuit is not being loaded down by R_L - when the connecting of R_L causes little change in V_1

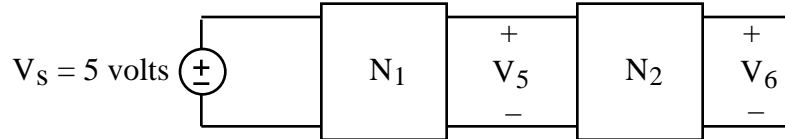
2. Given the following two circuits



- a. Measure your resistor values. Compare with nominal values
- b. Measure the transfer functions

$$G_1 = \frac{V_2}{V_1} \quad G_2 = \frac{V_4}{V_3}$$

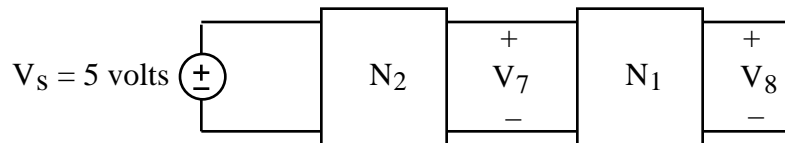
c. Now connect N_2 to N_1 as follows



and measure the transfer function

$$G_{12} = \frac{V_6}{V_s}$$

d. And then reverse the order of N_1 and N_2 as follows



and measure the transfer function

$$G_{21} = \frac{V_8}{V_s}$$

e. Explain why $G_{12} = G_1 G_2$ but $G_{21} < G_1 G_2$. Hint - find out what's happening to V_5 in the circuit of part (c) by replacing N_1 and V_s by its Thevenin Equivalent and N_2 by its equivalent resistance. And then do the same analysis to find out what's happening to V_7 in the circuit in part (d)