EXPERIMENT 4

MESH CURRENT ANALYSIS USING THEVENIN'S THEOREM, SUPERPOSITION THEOREM AND SOURCE TRANSFORMATION

Objective

This experiment is aimed at applying mesh current analysis using different theorems namely, thevenin, superposition and source transformation.

Tasks

1. Mesh Current Analysis

    a. Implement the following circuit (figure 1) on breadboard and Find the currents using multimeter (ammeter) in each of the mesh's.

    b. Solve for the mesh currents for figure 1 using hand analysis. Verify the results as obtained from step 1(a), 1(b).

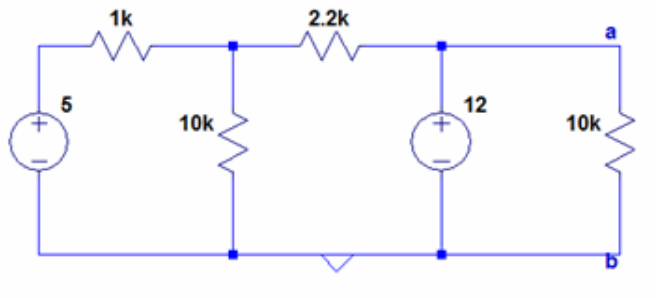


Figure 1.

2. Thevenin's equivalent circuit

    a. Implement the following circuit (figure 2) on breadboard and find the equivalent Thevenin circuit across "a" and "b".

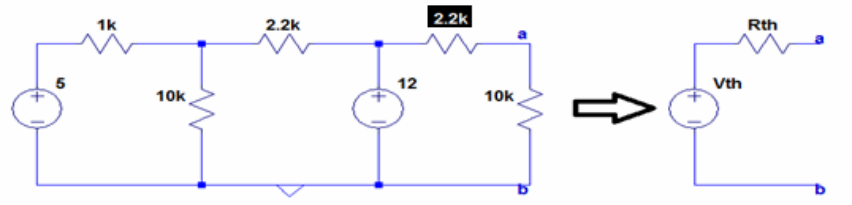


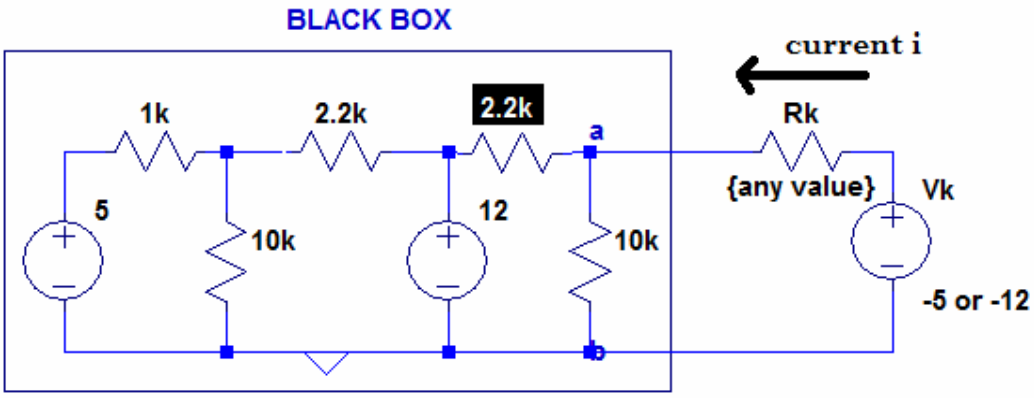
Figure2

b. Implement the circuit given in figure 2 in LTspice.

   i. Method 1 – measure open circuit voltage and short circuit current across "ab". Find Rth.

   ii. Method 2

   - ❖ Connect a known voltage source, Vk (say-5V) and a known resistance Rk. Consider the circuit in figure 1 as a black box and assume the voltage across the black box to be Vth and write the mesh equation.



   - ❖ Keep Vk = -12V and repeat previous step.
   - ❖ Solve these two simultaneous equations for current I and Vth. Find Rth from Vth and i.

c. Solve the thevenin's equivalent circuit for figure 2 using hand analysis. Verify the results as obtained from step 2(a), 2(b) and 2(c).

3. Superposition Theorem

   a. Make the following circuit (Figure 3) on breadboard. Find the net currents through each of the resistors using multimeter (ammeter).

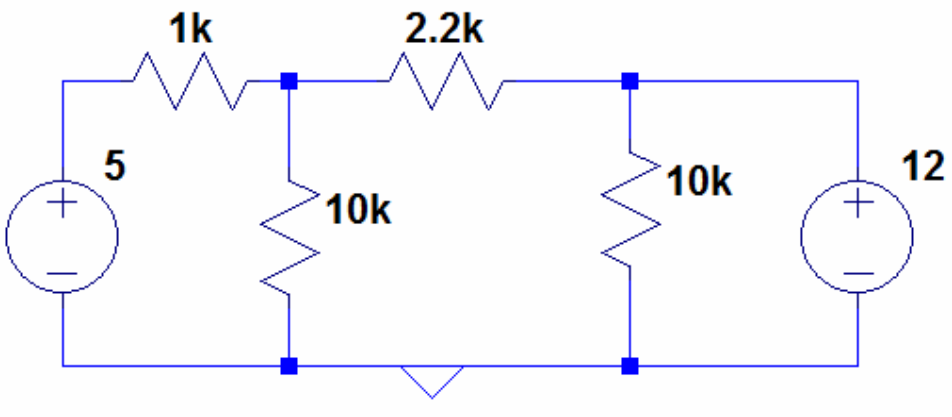
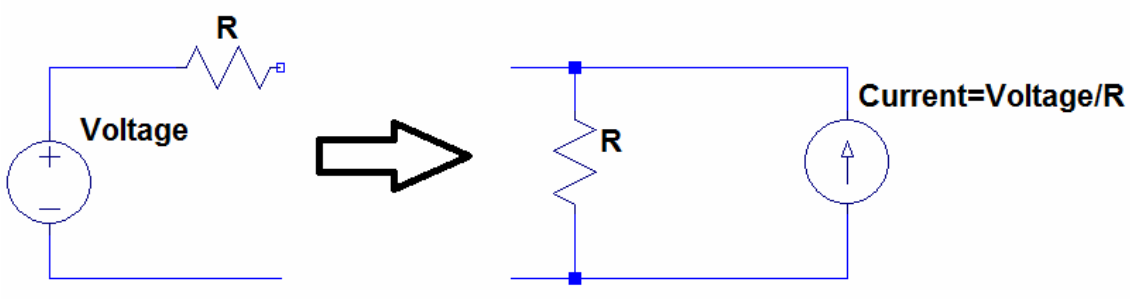


Figure 3

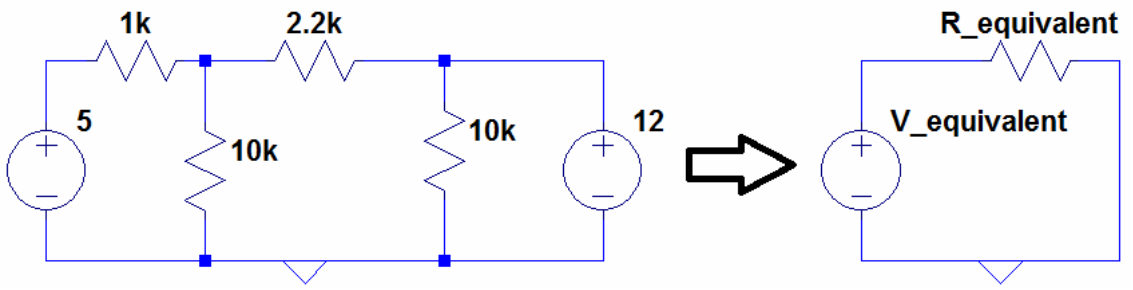
b. Implement the circuit given in figure 3 in LTSpice and find the currents through each of the resistors.

c. Solve for currents through each of the resistors of figure 3 using hand analysis. Verify the results as obtained from step 3(a), 3(b) and 3(c).

4. Source transformation



a. For the circuit given in figure 3, apply source transformation (hand analysis) and reduce the circuit to an equivalent voltage source and a series resistance.



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