Simulation # 3

Thevenin And Norton Equivalent Circuits

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Aim of the Expt.:

1. To obtain the Thevenin's and Norton equivalent circuits of the circuit provided
2. Simulate those circuits and compare their performance to the original circuit

Theory:

Statement of Thevenin's theorem:

An active network having two terminals A and B can be replaced by a constant-voltage source having an e.m.f. (V_{th}) and an internal resistance 'R_{th}'. The value of E is equal to the open circuit p.d. between A and B, 'R_{th}' is the resistance of the network measured between A and B with the load disconnected and the source emf replaced by their internal resistance.

- Internal resistance
  - Voltage Source -> Short circuit
  - Current source -> Open circuit

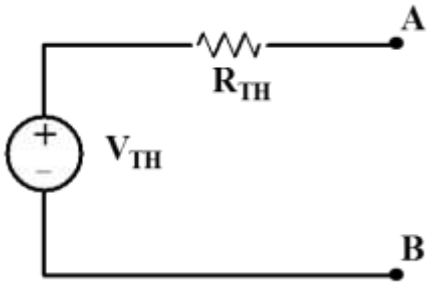

Figure 1 Thevenin's Eqv. circuit

Statement of Norton's theorem:

The current which flows in any branch of a network is the same as that which would flow in the branch if it were connected across a source of electrical energy, the short circuit current of which is equal to the current that would flow in short circuit across the branch, and the internal resistance of which is equal to the resistance which appear across the open circuited branch terminals.

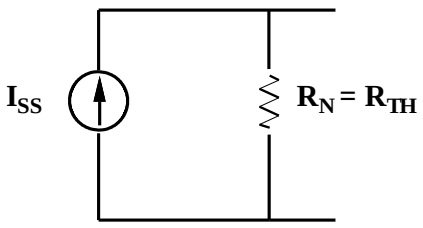

Figure 2 Norton's Eqv. circuit

Circuit Diagram:

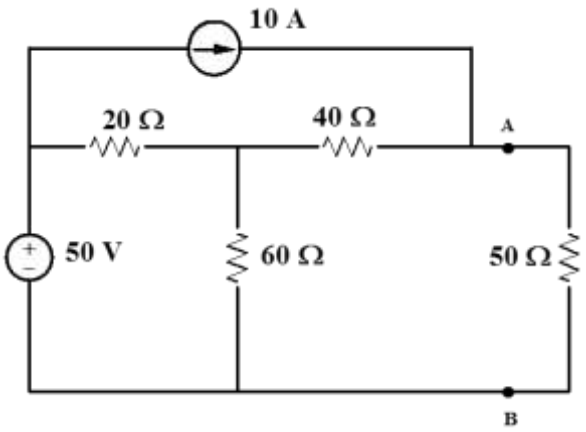

Figure 3 Circuit for simulation

Simulation:

1. Solve the given circuit (refer Figure 3) manually and find the Thevinin's and Norton's equivalent circuit across AB. Determine current through load resistance (50Ω) using both the methods.
2. Run the simulation for original circuit and obtain the load voltages V_o and I_o for load resistor R_L = 25 Ω, 50 Ω, 100 Ω.
3. Simulate the Thevenin equivalent circuit and the Norton equivalent circuit
4. For each of the three load resistors specified, obtain the load voltage and current for each case.

Questions:

1. Tabulate and Compare the simulation results of load voltages and currents among three circuits.

Sl. No.	**R_L (Ω)**	**Original circuit**		**Thevinin's**		**R_{th}=R_N**	**Norton's**	
		V_{AB}	I_{AB}	V_{th}	I_{AB}	R_{th}=R_N	I_{sc}	I_{AB}
1	25							
2	50							
3	100							

2. Compare Thevenin's and Norton's equivalent circuit.
3. For given circuit, find the value of R_L at which the current taken by the load circuit is 5 A.
4. For given circuit, what should be the value of R_L so that maximum power is delivered to the load?
5. State maximum power transfer theorem.