North East University Bangladesh

Department of CSE

Course no: CSE 122

Experiment no: 05

Experiment Name: Verification of Maximum Power Transfer Theorem

CAUTIONS:

1. **Don't switch on the supply of the circuit until you have verified the circuit carefully**
2. **Take readings of apparatus carefully**
3. **Take care of any bare circuit elements in energized condition**
4. **Never try to touch bare live wires**

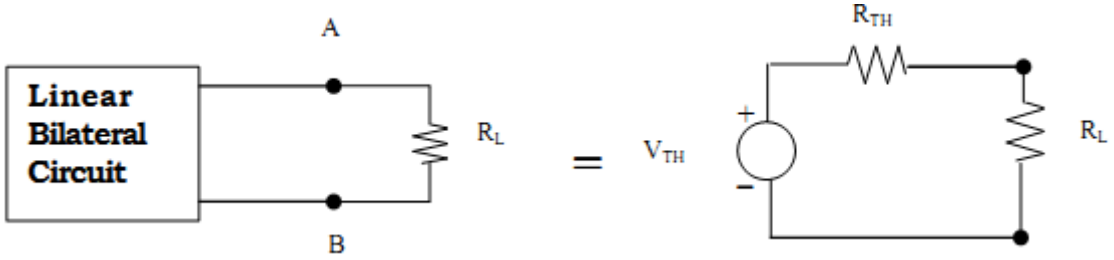
Part A: Verification of Maximum Power Transfer Theorem

Objective

The objective of this experiment is to verify maximum power transfer theorem.

Theory

The maximum power transfer theorem states that a resistive load will receive maximum power when its total resistive value is exactly equal to the Thevenin's resistance of the network as "seen" by the load.



We know that any circuit A terminated with a load R_L can be reduced to its Thevenin's equivalent. Now according to this theorem the load R_L will receive maximum power when

$$R_L = R_{TH}$$

The efficiency of power transfer is defined as the ratio of the power delivered to the load P_{OUT}, to the power supplied by the source P_{IN}.

$$\%\eta = \frac{P_{OUT}}{P_{IN}} \times 100 = \frac{V_L}{V_{TH}} \times 100 = \frac{R_L}{R_L + R_{TH}} \times 100$$

The voltage regulation is defined as

$$\%VR = \frac{\text{Load voltage at no load} \quad \text{Load voltage at full load}}{\text{Load voltage at full load}} \times 100$$

$$= \frac{R_{TH}}{R_L} \times 100$$

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At maximum power transfer condition, η= 50 % & VR= 100 %.
A relatively low efficiency of 50 % can be tolerated in situations where power levels are relatively low such as in electronic & communications circuits for transmission & reception of signal where the Engineer's goal is to receive or transmit maximum amount of power.

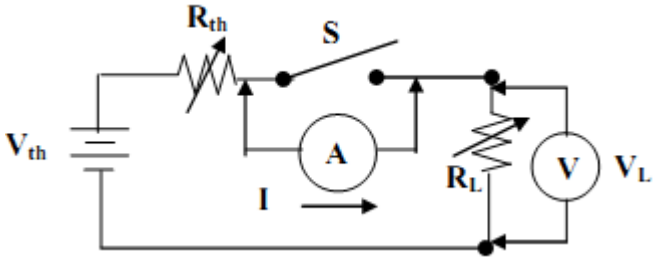
However, when large power levels are involved, such as at generating stations, efficiencies of 50 % would not be acceptable. The goal here is high efficiency and not maximum power. Power utility systems are designed to transmit the power to the load with the greatest efficiency by reducing the losses on the power lines. Thus the effort is concentrated on reducing $R_{TH,}$ which would represent the resistance of the source plus the line resistance.

Apparatus Needed

- Trainer Board (Bread board)
- DC Voltmeter
- DC Ammeter
- DC power supply
- Rheostats (RTH= 22Ω , RL= 44Ω)
- One multimeter
- Connecting wires

Procedure

1. Set up the circuit as in the figure below



2. Apply 5V dc from dc power supply.
3. Keep the Thevenin rheostat, R_{th} (22Ω) at maximum position.
4. Vary the load rheostat (44Ω) from minimum to maximum value in step & measure the voltages VL , & I. Take at least 15 sets of reading.
5. Keep the Thevenin rheostat at another position & repeat step 4.

Table

No. of Obs.	V_{TH}	V_L	I	$P_{IN}=V_{TH}I$	$P_{OUT}=V_LI$	LOSS= $P_{IN}-P_{OUT}$	%η	%VR	$R_L=V_L/I$
1.									
2.									
3.									
4.									
5.									

Report

1. Show the results in tabular form
2. Plot the following curves on graph paper
   a. % η vs RL
   b. % VR vs RL
   c. loss vs RL
   d. POUT vs RL
   e. IL vs RL
   f. VL vs RL

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