

Electrical Circuits LAB #5 - Thevenin/Norton Equivalents and Maximum Power

Objectives

Understand and apply Thevenin/Norton equivalents, source transformation and energy concepts to electrical circuit analysis.

Preparation

Complete the following steps before starting to work on the experiments in this lab:

- 1) Complete Lab 4 and associated report.
- 2) Read textbook, watch lecture videos, and complete homework in “Thevenin/Norton Equivalents and Source Transformation”.

Experiment 1

For this lab use:

- Solar Modules (SM) with Thevenin or open circuit voltage equal to 2 V and Norton or short circuit current equal to 8 mA.
- DC Motor (DCM) that requires voltage of 3.5 V and current at 30 mA to start and run the motor.

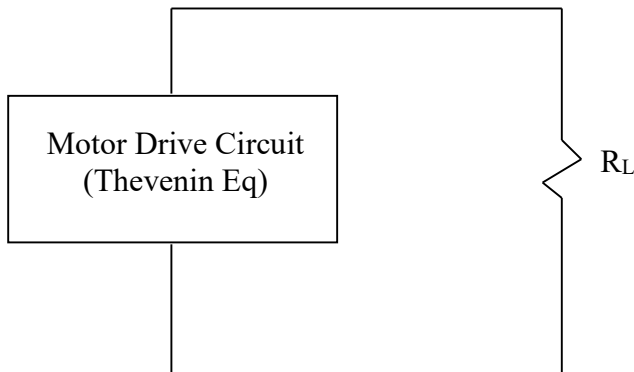
Determine the number of SM required in order to run the DCM. Use LTspice and Thevenin equivalent model of SM to show that your configuration and number of SM is sufficient to start and run the DCM.

Experiment 2

Repeat Experiment 1 using Norton equivalent model instead of Thevenin equivalent model.

Experiment 3

Calculate the load resistance for the motor driver circuit designed in Experiment 1 such that the load resistor receives maximum power.



Implement the circuit using LTspice and demonstrate that this value of R_L is indeed consumes maximum power and other R_L values consumes less than maximum power.

Hint: use .STEP directive to test R_L values from 1/10 to 10 times the selected value with steps of 1/100 of the selected value.

Report Requirements

This lab and associated report must be completed individually. All reports must be computer printed (Formulas and Diagrams may be hand drawn) and at minimum:

For each experiment include:

- Clear problem statement in your words.
- Answer to any specific experiment questions (if any)
- Identify the theory or process and associated calculations
- Documents resulting circuit schematics from LTspice, simulation output and additional tables, timing diagram or chart required by the experiment.

For the whole report include:

- A Cover page with your name, class, lab and completion date.
- A Lessons Learned section which summarizes your learning from this lab in 5 sentences or more.
- A New Experiment section that has description of a new experiment and the experiment's results. Experiment should be related to material covered in class but not simply variation of the existing lab experiments.