West Virginia University Lane Department of Computer Science and Electrical Engineering

Experiment #5 Line Losses

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Date Performed: 09/27/23

Due Date: 10/04/23

Table of Contents:

Lab Handout:

Objective & Equipment List for Each Experiment:

Objective:

The objective for this lab was to demonstrate the advantages of a transformer using voltage and current. It was to also show its importance in the modern day power systems.

Equipment:

- wires
- 30V/10 A connection on variable isolated transformer/ exciter (200 V/ 2 A was not working)
- Multimeter unit
- Transformer unit : L2 was used
- Variable resistor Box

Procedure & Wiring Diagram

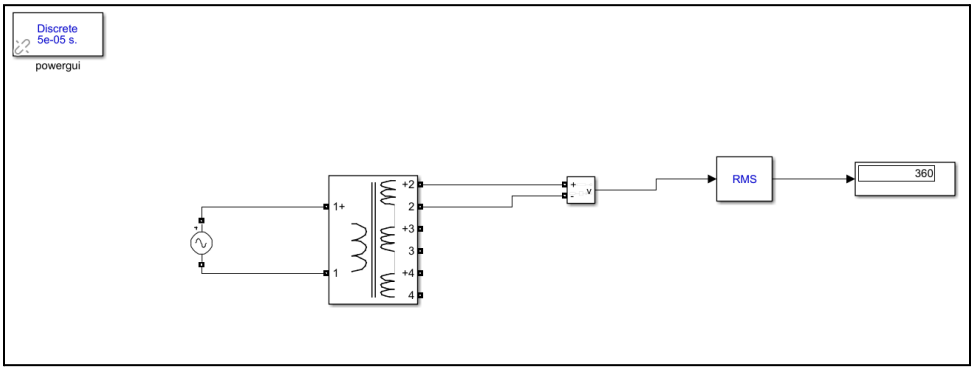

Figure 1. Multi Winding Transformer Voltage (V_{RMS}) Circuit

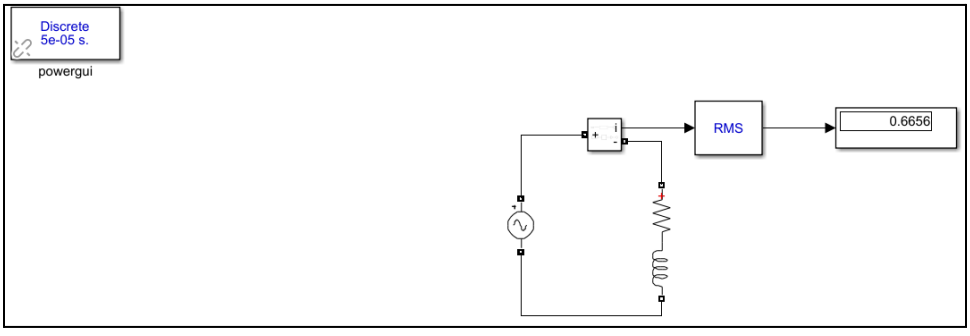

Figure 2. Multi Winding Transformer Current (I_{RMS}) Circuit

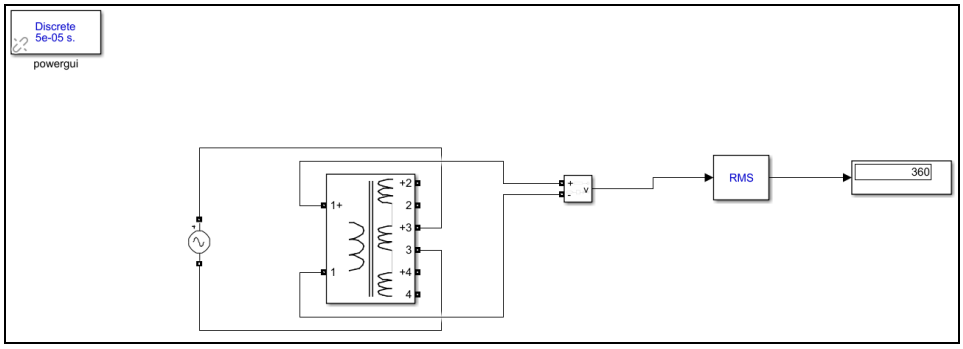

Figure 3. Transformer Impedance Voltage (V_{RMS}) Circuit

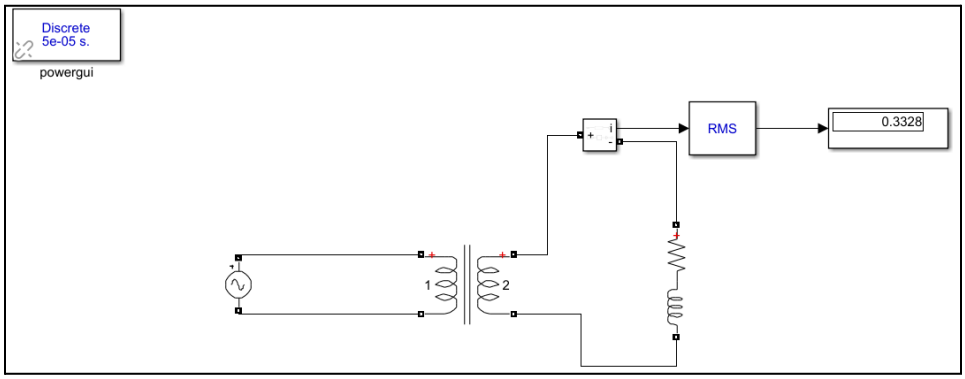

Figure 4. Transformer Impedance Current (I_{RMS}) Circuit

Experiment 1: Step Up and Step Down Transformer:

Experiment 2: Impedance Transform:

Without transformer
Resistance is 100 ohms
Inductance 0.397887 henry s
0.6656 Amps
180.27 ohms
Z' = 721 ohms

With transformer
I = 0.3328 amps
360.576 ohms

Observed and/or Measured Results:

Apply V_{in} at Terminals	Measure Voltage (V_o) at Terminals	Output Voltage (V_o)	Turn Ratio $a = Vin / Vo$	Operation (Step Up / Step Down)
1+/1	2+/2	240	120	Step up
1+/1	3+/3	40	3	Step Down
1+/1	4+/4	120	1	Level
3+/3	1+/1	360	1/3	Step Up
3+/3	2+/2	720	1/6	Step Up
3+/3	4+/4	360	1/3	Step Up

Observations and Conclusions (And theory):

Experiment 1

By changing the turns ratio for the transformer it was observed that different types of transformers are formed. Step up transformers means the voltage is stepped up. In practical applications this is used after the power is produced in the power plant so that to be transmitted the current is minimum. A high voltage and low current through a long transmission line is ideal for minimum losses in power. The step down transformer is used to decrease the voltage and increase the current closer to the load side. This is done to make the power levels be more suitable to its load. Normally this is at the end of the transmission line and closer to the distribution lines that power our homes. The third type we saw was the level transformer. This occurs when the turns ratio is 1. Generally this is called an isolation transformer. Oftentimes this is seen in the medical setting where two different circuits are to be used with the same voltage levels.

Experiment 2

As observed in the experiment the impedance transformer is a great way to transform how much impedance is seen by the source side. If the impedance is increased, as observed after adding the transformer we are able to minimize the losses.

Impedance transform is also a good way to solve a complex circuit by referring to moving the impedance to the primary/source side and doing simple ohm's law. Adjusting the turn ratio is also useful because this can solve many applications and power circuits having transformers.