LAB NO: 7

CALCULATING POWER FACTOR OF A THREE PHASE RL LOAD USING SIMULINK

Objective:

The main objective of this lab is to design a technique for the measurement of power factor of a three phase RL load in MATLAB Simulink.

Theory:

Power Factor:

The power factor is defined as the ratio of the active power (P) and volt-amperes. The active power is the real power which is assumed in an AC circuit, whereas volt-amperes is the apparent power which is produced in the circuit when the waves of voltage or current are not in phase.

For sinusoidal waveforms, the power factor is the cosine of the angle (phase angle) between voltage and current.

$$Power\ Factor = cos\emptyset$$

$$cos\emptyset = \frac{P}{VI}$$

$$I = \frac{P}{Vcos\emptyset} \dots\dots\dots\dots\dots equ(1)$$

Equation (1) shows that the current is affected by the power factor. Hence, for a given power P by the load, the current I, taken by the load varies inversely as the load power factor cosϕ. Thus, a given load takes more current at a low power factor than it does at a high power factor.
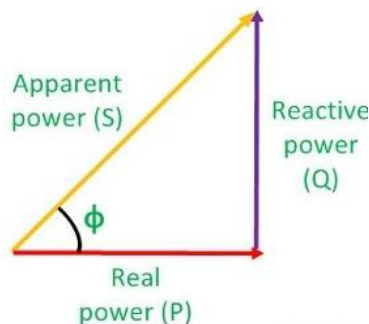

Figure 7.1: Power Triangle

How to Calculate Power Factor in Simulink?

- First of all, select a three-phase source block for simpowersystems library and set its parameters by double clicking it.
- Then select three- phase VI measurement block from simpowersystems library and connect it to the source block.
- Then select power, 3ph instantaneous block from simpowersystems library and connect it to the measurement block.
- Then select two product block add connect them to the output of 3ph instantaneous block.
- Then select an add block and connect it to the outputs of product block.
- Then select a sqrt block and connect it with the output of add block.
- Then select a divide block and connect its one terminal with P (of 3ph instantaneous block) and another with sqrt block.
- Then select a display block and connect with the output of divide block.
- After that, select three series RLC branch block and connect it with the output of measurement block and also specify its parameters.
- In the last, place powerGUI block and click ok play button to start the simulation
- The power factor can be seen in the display block.

The simulation results are shown in the figures below:
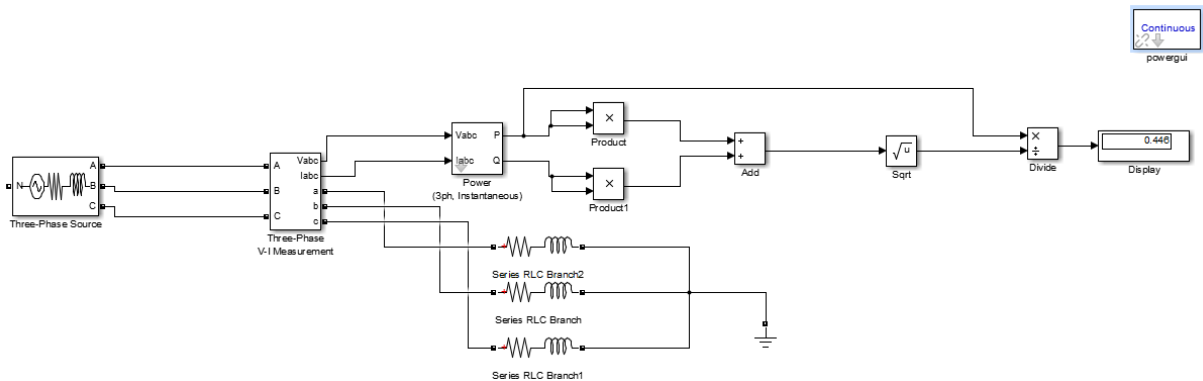
Figure 7.2: Simulation Results for the Measurement of Power Factor in 3-Phase RL Load

POST LAB QUESTIONS:

Q1: What are the causes of low power factor?

Q2: what are the disadvantages of low power factor?

Q3: what is meant by lagging and leading power factor?

Teacher Remarks:

Obtained Marks: / 10

Electrical Engineering Department INU