LAB NO: 8

POWER FACTOR IMPROVEMENT OF A THREE PHASE RL LOAD USING SIMULINK

Objective:

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

Theory:

Power Factor Improvement:

The power factor improvement means bringing the power factor of an AC circuit nearer to one by using the equipment which absorbs or supply the reactive power to the circuit. Usually, the power factor correction can be done by using the capacitor and the synchronous motor in the circuit. The power factor correction will not change the amount of true power, but it will reduce the apparent power and the total current drawn from the load.

The phase shift between the voltage and the current of the circuit is known as the power factor. It is represented by the cosine of the angle φ. The power factor represents the fraction of total energy use for doing useful work, and the remaining energy is stored in the form of magnetic energy in the inductor and capacitor of the circuit. The value of power factor lies between -1 to +1.

The most economical value of power factor lies in between 0.9 to 0.95. If the value of power factor lies below 0.8 (approx.), then it draws more current from the load. The large current increases the losses and requires a large conductor, thus increases the cost of the system. The loss can be reduced by correcting the power factor of the system.

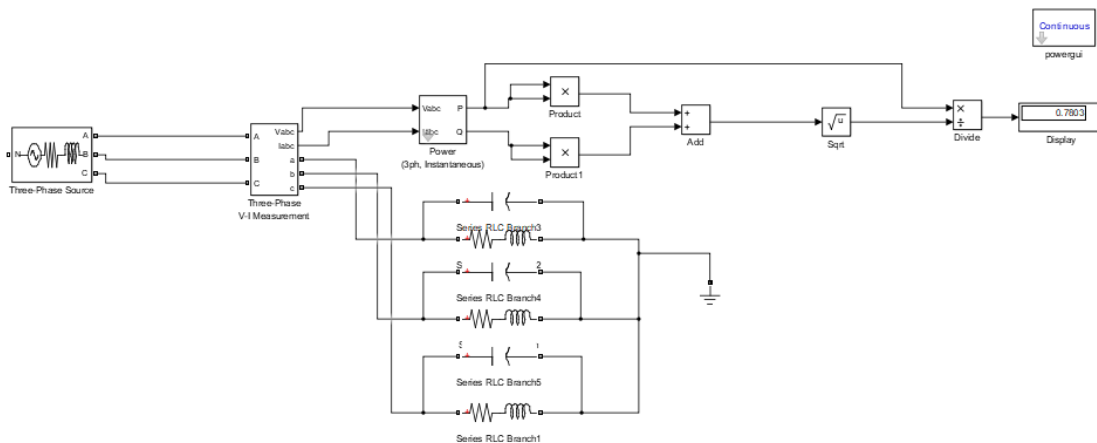## How to Improve Power Factor in Simulink?

- 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 which is 0.446 as shown in figure 8.1.
- Now to improve this lagging power factor, we will connect capacitors in parallel with the loads as shown in figure 8.2.
- After power factor improvement, the power factor is improved to 0.78 as shown in figure 8.2.

The simulation results are shown in the figures below:
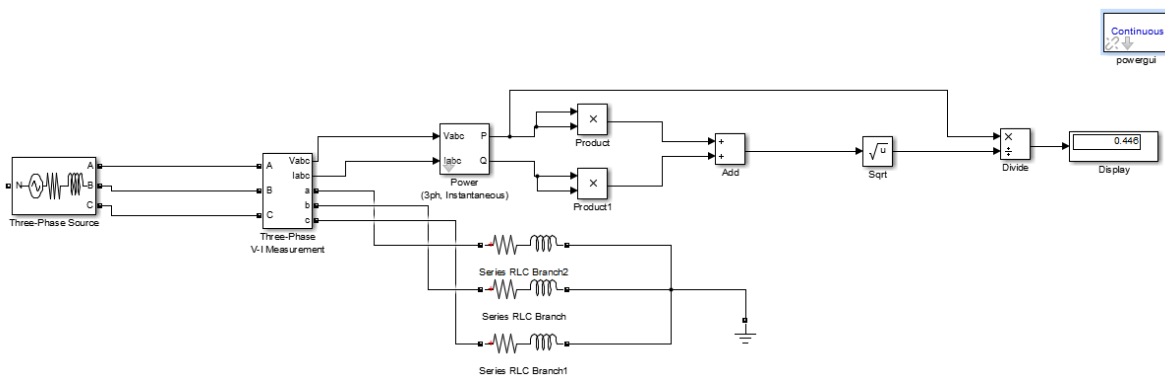
Figure 8.1: Simulation Results before Correction of Power Factor

Figure 8.2: Simulation Results after Correction of Power Factor

POST LAB QUESTIONS:

Q1: What are three methods used to improve power factor?

Q2: what is meant by synchronous condenser?

Q3: how to connect capacitor bank in delta and star?

Teacher Remarks:

Obtained Marks: / 10