EE160 Lab Assignment-4

Lab section 1A

Power Factor Correction in Electrical Power System

Karan Acharya
202251064

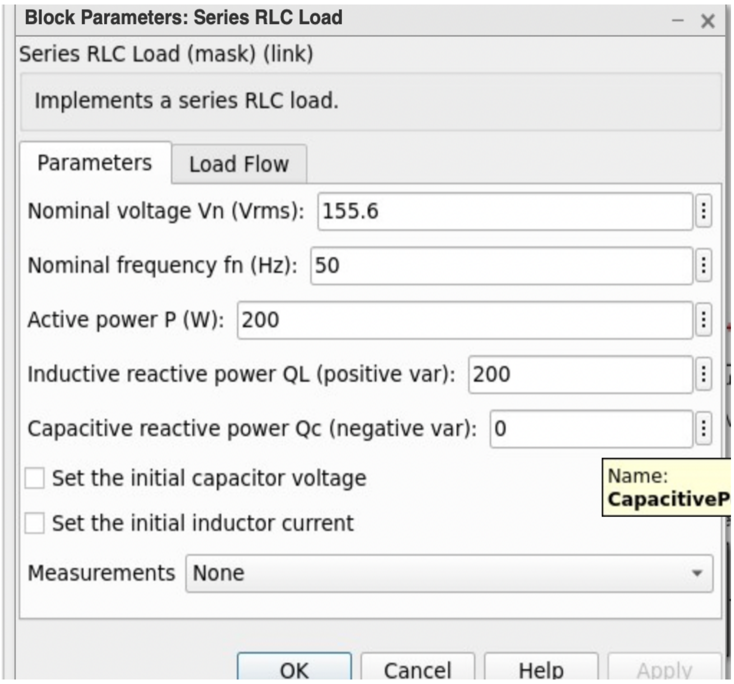
Objectives: Design and simulate a circuit in Simulink with an AC source connected to a series RLC branch and a series RLC load, and then convert the series RLC branch and RLC load to RL components for analysis.

Parameters for Circuit 1 (No Parallel capacitor):

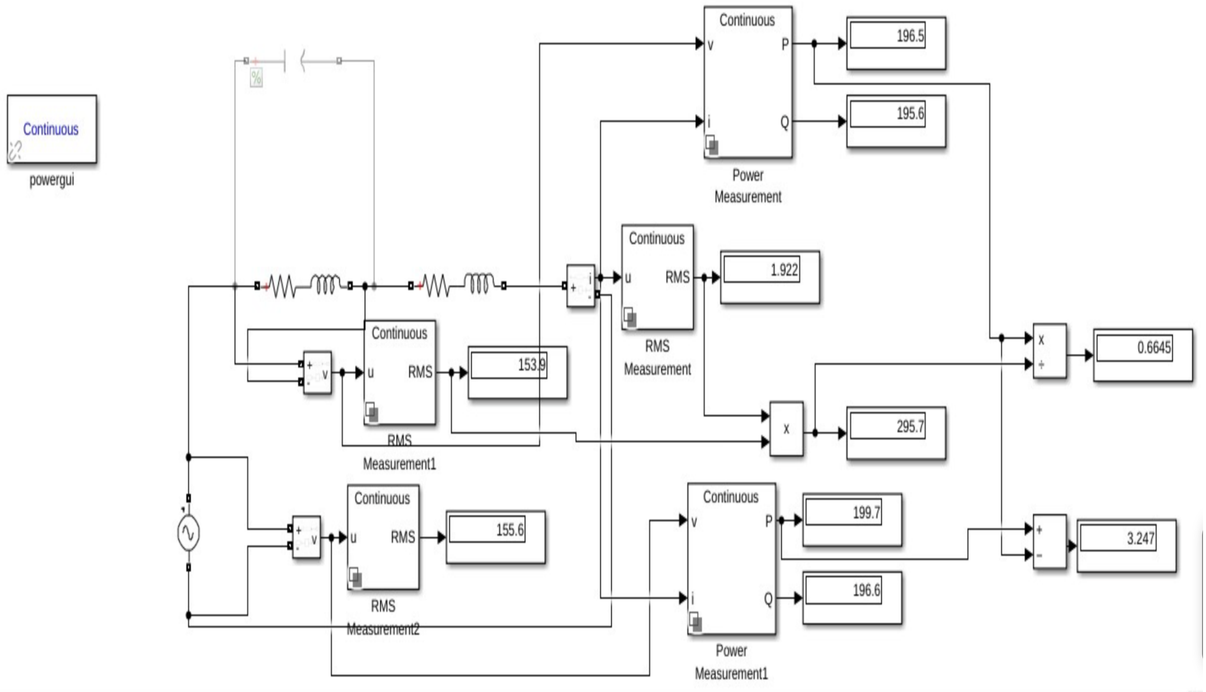
Input voltage = 220V
Frequency = 50Hz

Series RL branch-
R = 1 Ω
L = 10^{-3} H

Series RL Load-



Circuit 1 :



Power Factor = cosΦ = Real Power / Apparent Power

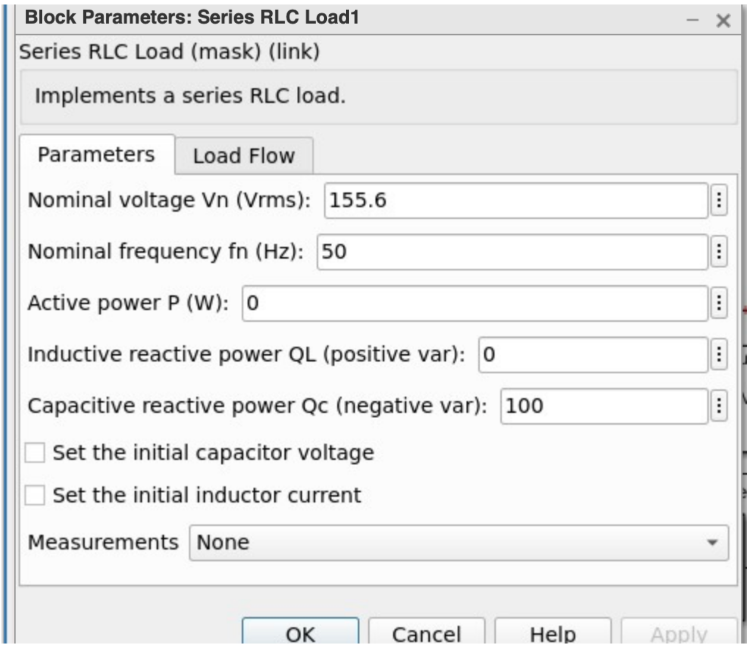
= Real Power / ($V_{RMS} \times I_{RMS}$)

= 0.6645

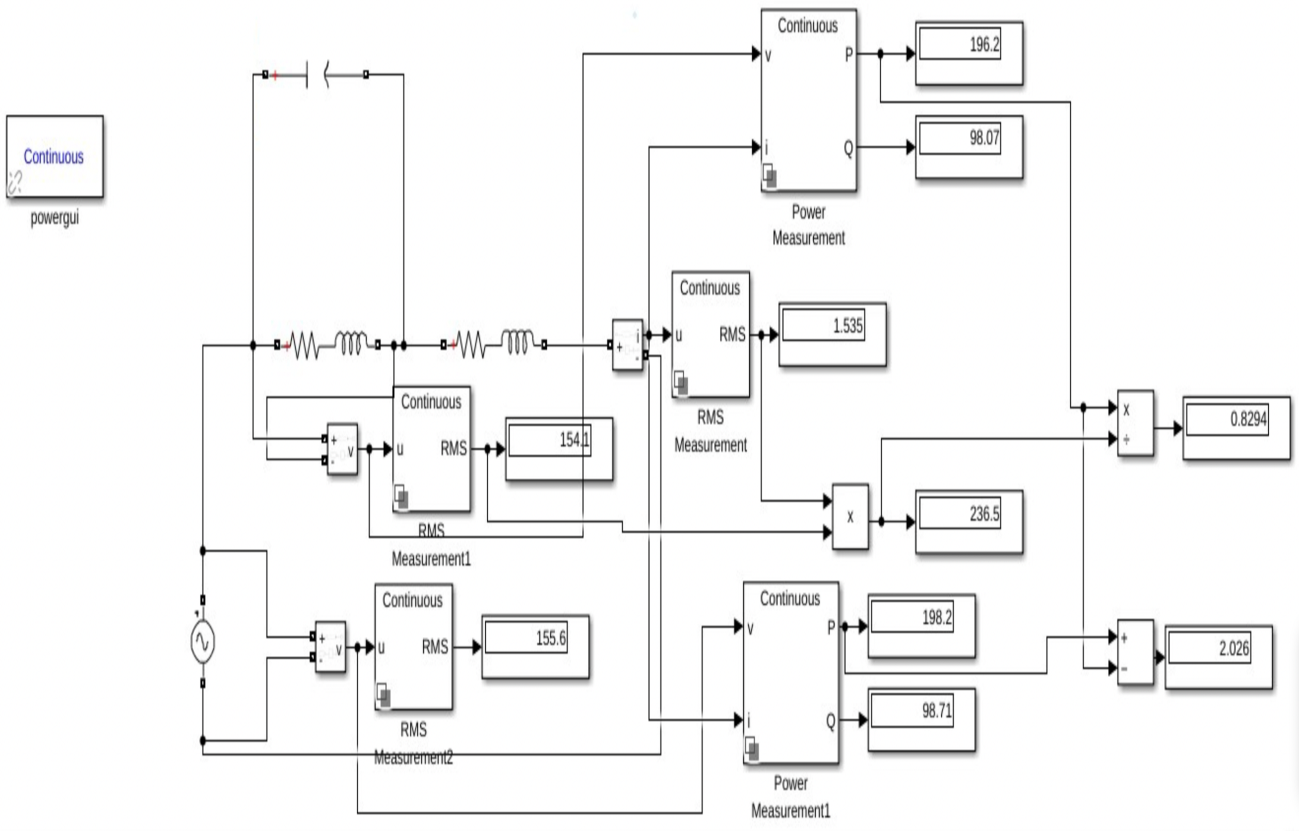
Power Loss (Real Power) = Source Power - Load Power

= 3.247 W

Parameters for Circuit 2 :



Circuit 2:

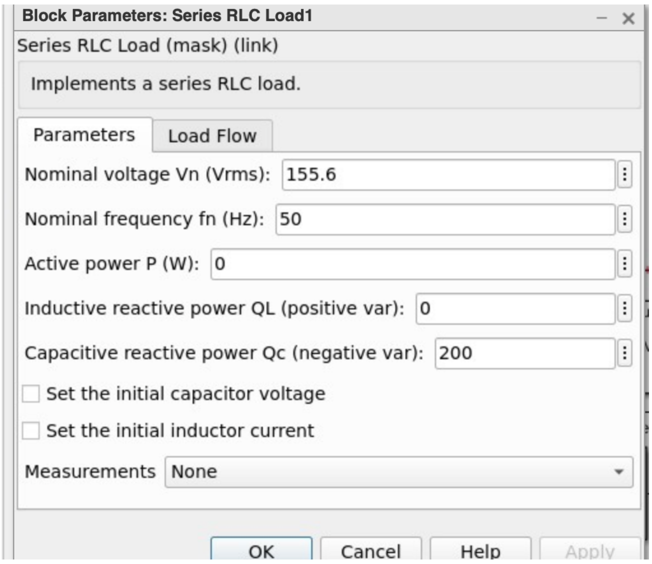


Power Factor = cosΦ = Real Power / Apparent Power

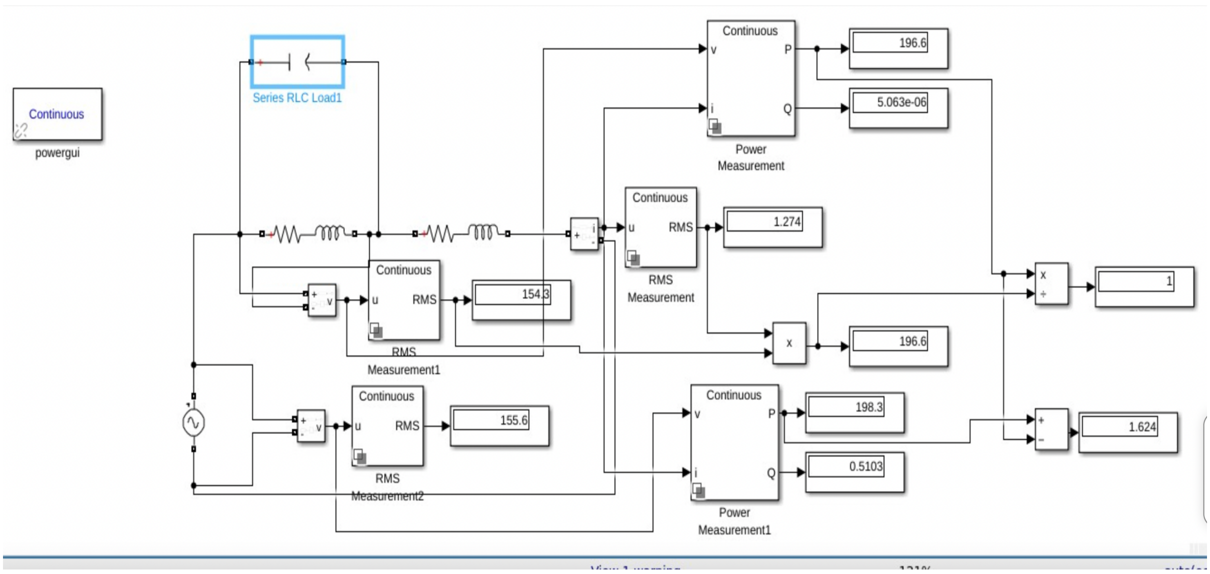
= 0.8294

Power Loss = 2.026 W

Parameters for Circuit 3:



Circuit 3:



`

Power Factor = cosΦ = Real Power / Apparent Power
= 1
Power Loss = 1.624 W

Formula :

KVAR (capacitance reactive power in kilo) =$2\pi f \times C \times V_{RMS} \times V_{RMS}$

V_{RMS} = 154.9 V , f= 50 Hz ;

Observation (Capacitance and Capacitive load) :

Q_c(Capacitive Reactive Power)	**C**(Capacitance)	Power Factor
100	1.327×10^{-6}	0.8294
200	2.654×10^{-6}	1

For Q_c=200 VAR and Q_L = 200 VAR the load and capacitor compensate for each other's effect and power factor comes out to be 1.

Conclusions:

1. A capacitor can offset the reactive power in the circuit and improve the power factor, thus increasing the efficiency of the system.
2. As reactive power increases, I_load increases.
3. When power factor is nearly equal to 1, C = 11.94×10^{-6} C,Inductive reactive power must be equal to capacitive reactive power.