ECE 2101L
Electrical Circuit Analysis II Laboratory

Lab 12 and 13
Maximum Power Transfer and Power Factor Correction

Report

Choi Tim Antony Yung

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1 Maximum power transfer

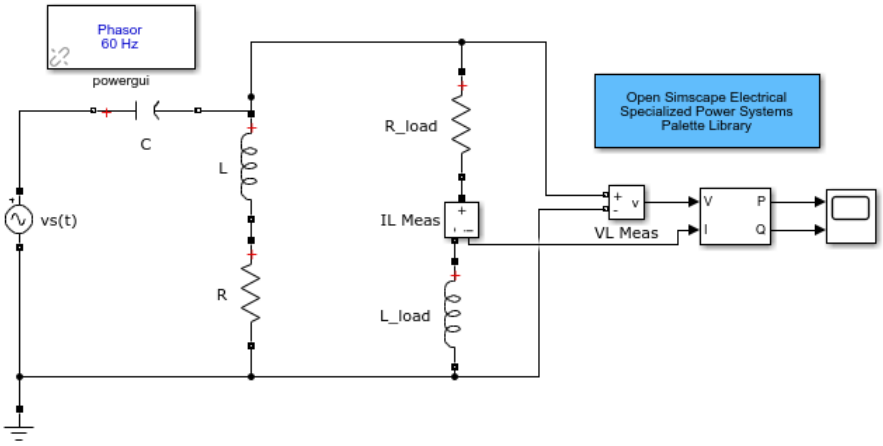

Figure 1: Simulation of the circuit with MATLAB Simulink

Result

C = 220 µF for Partner 3

Variant	Load Impedance Z_L		Calc Power		Meas Power		Error P, %
	R, ohm	X, ohm	P, W	Q, VAR	P, W	Q, VAR	
0.5 Z_{L_OPT}	0.5278600	0.01718051	NA	NA	34.49	423.2	NA
0.8 Z_{L_OPT}	0.8445760	0.02748882	NA	NA	237.7	2,916	NA
Z_{L_OPT}	1.055720	0.03436103	687.8733	NA	687.9	8,440	0.00
1.2 Z_{L_OPT}	1.266864	0.04123323	NA	NA	304.0	3,730	NA
1.5 Z_{L_OPT}	1.583580	0.05154154	NA	NA	94.04	1,154	NA

Analysis

After changing the 80 Ω resistor to a 330 Ω resistor and changing the load inductor and resistor such that the power transfer to load is maximized, the maximum average power increased from 687.9 W to 1502 W. This is due to a decrease in load impedance and an increase of voltage of the load impedance.

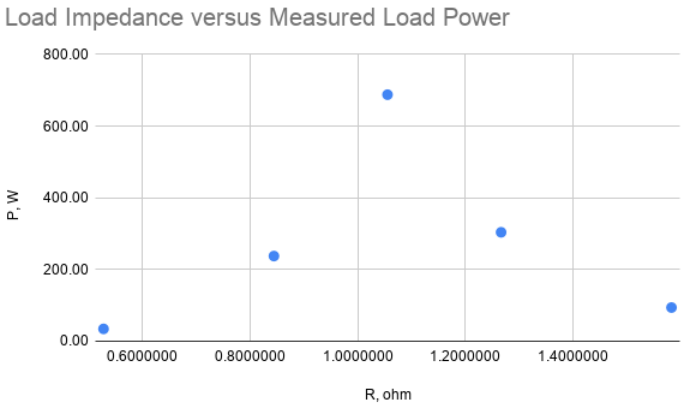

Figure 2: Load Impedance versus Measured Load Power

2 Circuit maximum gain and phase shift

Result

	Load PF	Meas V1 RMS, V	Meas I1 RMS, A	Meas V2 RMS, V	Meas I2 RMS, A	Meas P loss, W	Meas Q loss, VAR
Original PF	0.72	11000	4.911	229	219.4	2630	2700
Corrected PF	0.95	11000	3.813	232.4	169.6	1980	2020

Analysis

As seen in the above table, the current I1 and I2 decreased as the load draw less apparent power from the source. The voltage V2 decreased as the power dissipated from the wire decrease and the power dissipated from the load increase. As the current decreases, the power dissipated in wire decrease, hence the decrease in power loss.

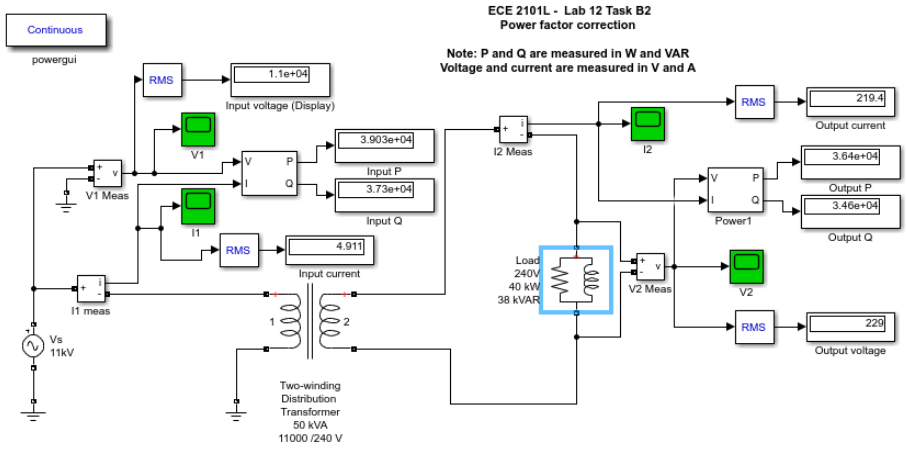

Figure 3: Simulation of the circuit with original PF = 0.72

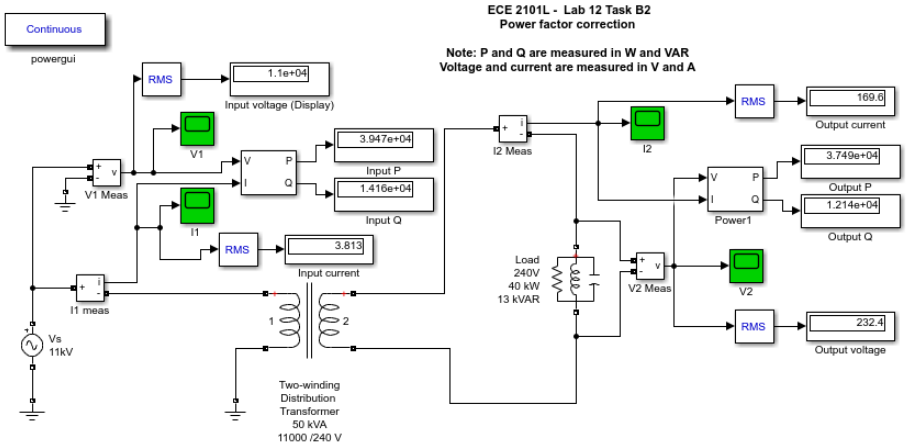

Figure 4: Simulation of the circuit with corrected PF = 0.95