ELEC 302 Lab 1
Power in AC Circuits

REFERENCE: Appropriate chapters of ELEC 201/202 text.

OBJECTIVE: The objective of this experiment is to determine the real power, apparent power, reactive power, and power factor of an RLC circuit.

EQUIPMENT:

Power Supply Module (0-120Vac)	EMS 8821
Resistance Module	EMS 8311
Inductance Module	EMS 8321
Capacitance Module	EMS 8331
Data Acquisition Interface	EMS 9062
DAI 24V Power Supply	EMS 30004

Notes: This entire experiment is conducted at 60 Hz. All of the currents and voltages in this experiment are RMS

INTRODUCTION:

In this experiment, you will vary the capacitance in a parallel RLC circuit. You will analytically and experimentally determine the circuit power factor, the real power, and apparent power of the circuit.

PRIOR PREPARATION:

Complete the following at a time determined by the laboratory instructor.

Utilize the circuit element values given in Figure 1.1 and Table 1.1. For all cases shown in Table 1.1, determine the theoretical values for I1, E1, P, S, Q, and p.f. Show all of your work and summarize your results in a table.

PROCEDURE:

WARNING!
High voltages are present in this laboratory experiment!
Do not make or modify any banana jack connections with the power on!

1. Verify the all components required in the equipment section are present at the EMS workstation.

2. Make sure the main power switch of the Power Supply is OFF, the voltage control knob is fully CCW. Set the voltmeter selector switch to position 4-N.

3. Construct the circuit of Figure 1.1. Leave the capacitor out of the circuit at this point. It will be installed at a later step. I1 and E1 refer to the DAI metering connections.

4. Ensure the DAI 24V supply is connected to the main Power Supply (turn it on), and the DAI USB connector is attached to the computer.

5. Start the computer and the LVDAM EMS application. On the *File* menu open file C:\Program Files\Lab Volt\Samples\E302_1.dai. Three windows should appear. The Metering window should display meters for E1, I1, and P. The Oscilloscope window should display CH1 set to E1 and CH2 set to I1. The Phasor Analyzer window should have both E1 and I1 selected.

6. Select focus to the metering window by clicking on it. Select *Options* -> *Acquisition Settings*, set the *Sample Window* dialog box to *extended*. Then click OK, and close the box. Select *View* -> check *continuous refresh.*

7. Turn on the main voltage power supply and adjust the supply voltage to the proper voltage. Monitor both the installed EMS voltmeter, and the metering window for proper indications. If proper indications are not immediately established, turn the voltage control knob CCW and turn off the power supply. Obtain instructor assistance.

8. Record in Table 1.1 the load voltage E1 and load current I1, and the real power consumed by the circuit P.

9. Select focus to the Phasor Analyzer window by clicking on it. Select E1 as the reference phasor. Select *View* -> check *continuous refresh.* Record the phase angle θ.

10. Select focus to the Oscilloscope by clicking on it. Select *View* -> check *continuous refresh.* Both E1 and I1 should be displayed for visual reference.

11. Turn the voltage control knob CCW, and turn off the main power supply.

12. Rewire the circuit of Figure 1.1 to include the capacitor. Repeat steps 7 through 9 to complete Table 1.1.

    Note: Before making any circuit changes that require installing or removing leads verify the power supply voltage is turned to zero and the power supply circuit breaker is open.

REPORT:

Your report should be completed in the format requested by the instructor. Specifically, it must contain the following items.

1. Complete table 1.1 using the experimental values.
2. Compare the experimental to the theoretical results. Compute and tabulate the percent difference for the power factor at each case.
   Note: Percent Difference = [Experimental –Theoretical] x 100 / Theoretical.
3. Identify the capacitance values that result in the minimum line current for both the 0.8 H and 1.6 H inductors. Discuss why this occurs.

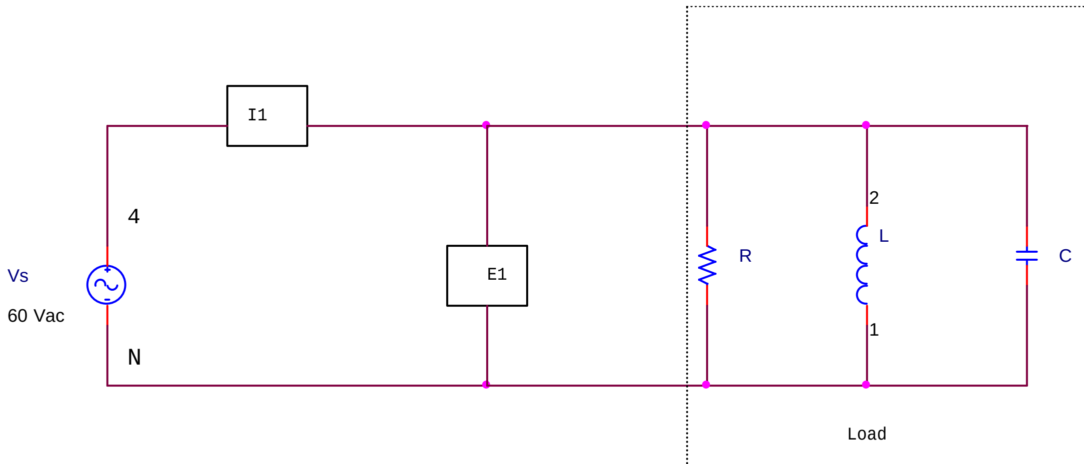

Figure 1.1 Parallel RLC circuit configuration

R Ω	L H	C μF	I1 A	E1 V	P W	Θ Deg.	S VA	Q VAR	p.f.
1200	0.8	---							
1200	0.8	2.2							
1200	0.8	4.4							
1200	0.8	8.8							
1200	1.6	---							
1200	1.6	2.2							
1200	1.6	4.4							
1200	1.6	8.8							

Table 1.1 Experimental Data