Lab Final: Part 2

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You may not collaborate with other students on this project. If it is discovered that you gave assistance to or received assistance from another student, <u>you will automatically receive a grade of 0</u> for part 1 and part 2 of the lab final.

A location in the power system can be modeled by the circuit in Figure 1. The line is modeled as a resistor and the load is modeled by a series resistance and inductance. The systems details are as follows:
- $v_S(t) = 5\cos(628.32t + \theta_{vs})$ V (Set the function generator, FGEN, to output this voltage; your actual output will not perfectly match this.)
- $R_{LINE} \approx 10\ \Omega$
- $R_{LOAD} \approx 330\ \Omega$
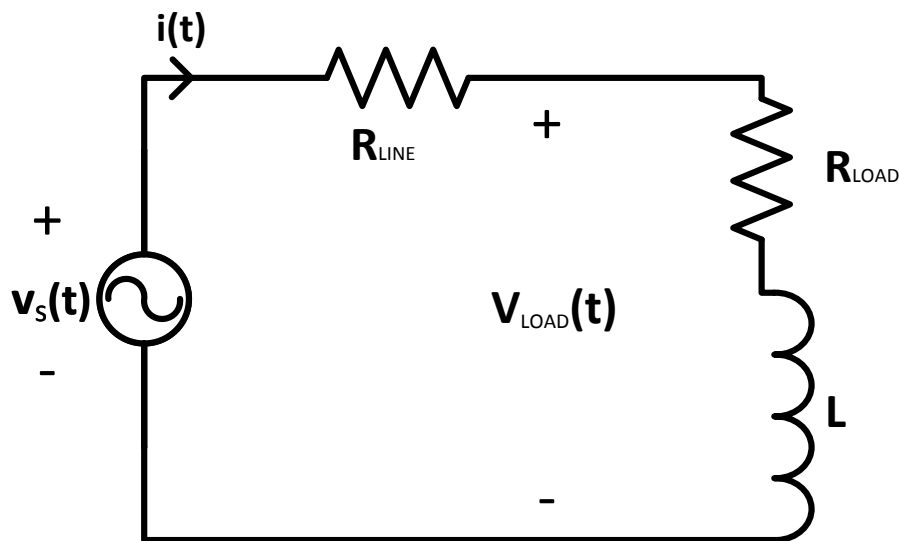- $L \approx 0.4$ H

Figure 1: Power System Model

You have been assigned to choose a capacitor to insert in parallel with the load (see Figure 2) to adjust the load's power factor to within the following limits:
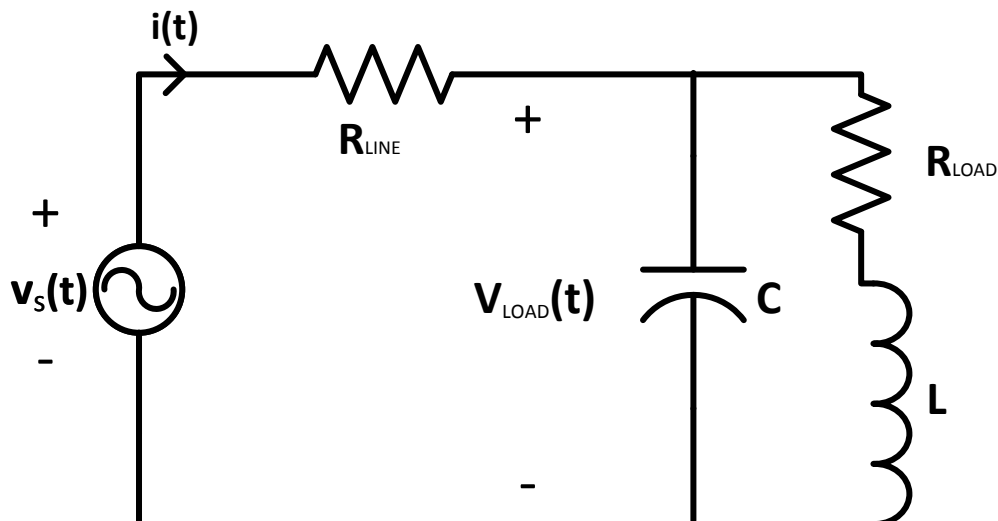- $0.970 \leq$ pf ≤ 0.990 <u>lagging</u>

Figure 2: Power System Model for pf Correction

Your grade is dependent on the following (no lab report is required):

- Successful <u>design</u> of C.
- Successful <u>justification</u> to the T.A. of your selection of C (via measurements of R-L circuit, mathematics, simulation, and/or answering your T.A.'s verbal questions - DO NOT USE MULTISIM AS A TRAIL AND ERROR ONLY).
- Successful <u>construction</u> of your design using the NI ELVIS lab equipment.
- Successful <u>demonstration</u> of the operation of your design using the NI ELVIS oscilloscope and necessary calculations using the oscilloscope's measurement(s) to prove you've met the requirements for pf.

You are <u>not</u> permitted to use the theoretical values for $v_S(t)$, R_{LINE}, R_{LOAD}, or L in the justification of your design. Only measured values can be used.

Design Hints:

- Treat the phase on the source voltage, θ_{Vs}, as 0°.
- You may combine multiple capacitors to build the C you use in your breadboarded circuit. However, you may not use more than <u>four</u> capacitors.
- The sequence of measurements and calculations from Experiment #12 will serve as a helpful reference.