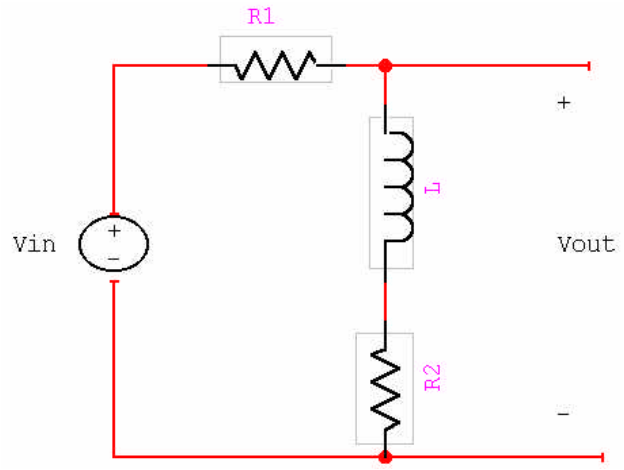
ECE 210 - Design Project #2

Introduction

The network shown below is an example of an analog circuit known as a *filter*. As discussed in class, elements such as inductors and capacitors have different impedances at different frequencies. Therefore, this circuit has different behavior for different ω.



Filters are useful for eliminating unwanted frequencies from a signal. For example, telephone transmission lines often include filters that remove 60 Hz interference caused by nearby power lines.

Problem Statement

You are to design the circuit (i.e. *you must use your engineering judgement to appropriately choose values for R1, R2, and L)* to meet the following specifications:

(1) At very low frequencies (ω→0), the gain of the circuit (Vout/Vin)→ 0.5.
(2) R1, R2, and L must be chosen so that they are readily available in our lab. (i.e. 10Ω<R<1MΩ, and 1mH<L<1H).
(3) The phase of Vout is 14.04° at ω=25,000 rad/sec.

It is given that $V_{in} = V_m \cos(\nu t) = V_m \angle 0$.

Report

This assignment will count as a portion of your "design projects" grade, and hence the report must be well written and complete. Typing the reports is desirable, but no penalty will be given for handwritten submissions, provided they are *extremely* neat and readable.

Provide the following sections in your report:

- **Problem Statement** – What are you trying to solve?
- **Design Objectives** – What should the design accomplish?
- **Design –** *Show All the steps of your design*. This is the most important part of the assignment, and will count as at least 50% of your grade. *Clearly* show attempts at solutions and explain your work (in words if necessary), even if your attempts are unsuccessful. **Clearly highlight your solution.**
- **Analysis (*Notice this is a new section)* –** Plot the magnitude and phase of your circuit as a function of ω (Both Matlab and Microsoft Excel are capable of doing this. Handwritten graphs are also acceptable if done neatly). Choose an appropriate range of frequencies. A log scale on ω may be appropriate.
- **Conclusion** – Explain what your analysis shows. Furthermore, what did you learn from this project?