

ENGR 252 LAB #6 -- Filter Design and Analysis

"This lab & associated report should be completed individually"

Objective

Utilizing Computer Aided Design and Analysis tools to design and analyze active and passive filters.

Related Principles

- *Electrical Circuits* textbook.
- *OrCAD Capture and PSpice Integrated Tutorial*

Equipments

- Windows-based PC
- Cadence orCAD 16.6 lite
http://www.engr.cs.com/tools_programs/16.6_OrCAD_Lite_Capture&PSpice_Products.zip
- USB hard disk or other removable drives

Supplies

- None

Preparation

- OpAmp Model
This lab uses LM 324 (a single supply OpAmp) with model available in the EVAL library of PSpice.
- Op Amp (LM 324) Data Sheet available at:
http://www.engr.cs.com/components/LM324_OpAmp.pdf.
- Online PSpice videos on EngrCS youtube channel.

Experiment #1

Implement a filter that will only pass through 5 to 15 kHz signals. The filter gain outside of this frequency range should be at least 3 dB below the gain at the center frequency.

- Design the circuit using passive filter design(RLC).
- Create a schematics in PSpice
- Simulate your design in PSpice with input signal $v_i(t)=2\cos(20,000\pi t)$
- Plot at least one cycle of input and output signal in time domain
- Plot transfer function $H(s)$ magnitude in Frequency Domain and explain if it meets the design objectives.

Experiment #2

Repeat Experiment #1 using active filter designed with LM324 OpAmp.

Experiment #3

Add 10 Ω loads to each of experiment #1 and #2 designs. Explain how the behavior of each circuit changes from no load to loaded with respect to design objectives. Which would you recommend to be used with 10 Ω load and why?

Report Requirements

This lab and report must be completed individually. All reports must be computer printed (Formulas and Diagrams may be hand drawn) and at minimum include:

For each Experiment

- a) Clear problem statement; specify items given and to be found.
- b) Identify the theory or process used.

- c) Documents resulting circuit, calculation, tables, timing diagram, schematic and other relevant results.

For the report as a whole

- a) Cover sheet with your name, class, lab, completion date and team members' names.
- b) Lessons Learned from the experiments.
- c) A new experiment and expected results which provide additional opportunity to practice the concepts in this lab.