ActiveHighPassFilter -- Overview

Dr. B Kanmani
Department Head,
Telecommunication Engineering

BMS College of Engineering (BMSCE),
Bangalore, India

OBJECTIVES:

At the end of performing this experiment, learners would be able to:
• Describe the concept of active High Pass butterworth Filter
• Obtain the roll-off factor and cutoff frequency of the filter designed
• Compare the designed cut-off frequency with the desired cut-off frequency
• Understand the working of µA741 IC (Op Amp)

EQUIPMENT:

• IC µA741
• Signal generator
• Resistors
• Capacitor
• +/- 15V DC Power Supply
• Digital Storage Oscilloscope & probes
• Connecting wires & Bread Board

DESIGN:

• Given cut-off frequency f Hz, assume suitable R, and obtain C using equation

$$f_c = \frac{1}{2\pi RC} Hz$$

• Assume R1 and compute R2 using equation

$$A_F = \left(1 + \frac{R_2}{R_1}\right) = 1.586$$

THEORY:

• Op - Amp is a DC-coupled high-gain electronic voltage amplifier with a differential input and a output.
• The µA741 device is a general-purpose operational amplifier featuring offset-voltage null capability
• The low pass filter becomes a high pass filter when the Resistor

and Capacitor are interchanged.

Reference reading:

1) Theory and application of Digital SIgnal Processing, by Lawrence R Rabine and Bernard Gold, Prentice Hall, Easter Economy Edition
2) Integrated Electronics, by Millman and Halkias, Tata McGraw-Hill

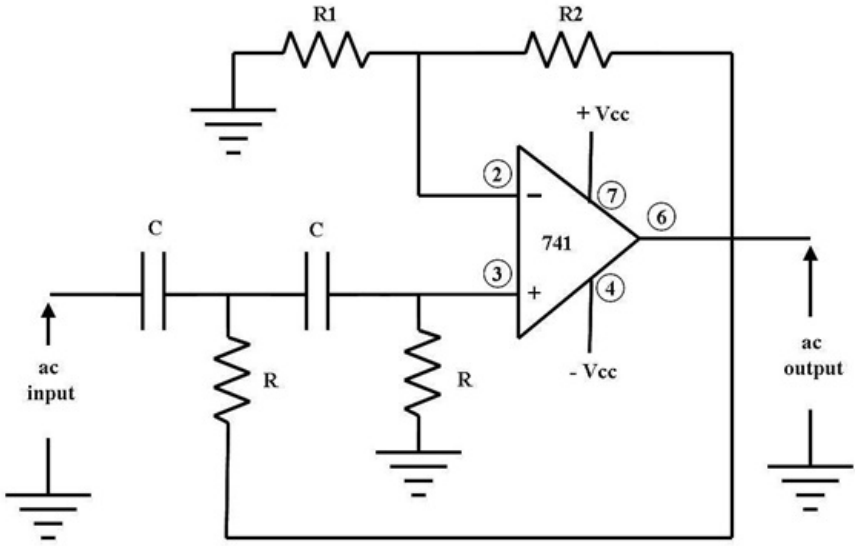
Acknowledgement

Mr.Shreenivas B for converting laboratory experiment to Tektronix courseware format

ActiveHighPassFilter -- Procedures

Step 1

Circuit setup:
Build the following circuit with given designed values



Active second order High pass filter

Step 2

• Use a signal generator to generate analog input . The analog input will be set to 1 Vpp Sine wave
• Turn on the supply of the circuit and enable signal generator that is feeding signal to the circuit.

Step 3

• Connect the DSO probe – CH1 at analog input (Sine wave), CH2 at output (pin # 6 of µA741 IC)
• Perform Autoset on DSO and capture the output signal.

Step 4

• Configure PEAK-to-PEAK measurement on the input and output signal.
• Observe and record the signal – input and output.

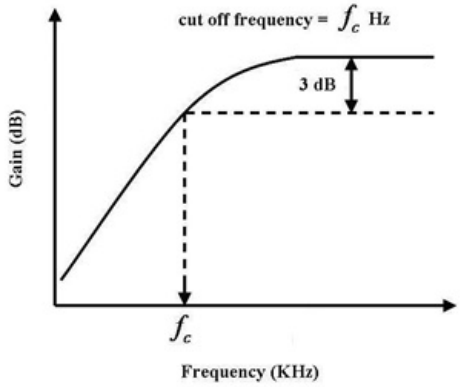
Step 5

Record the input and output peak-to-peak voltage for various input frequencies, and complete the table below

Frequency (Hz)	**V input (v)**	**V output (v)**	**Gain (dB) =** 20 log (Vout / Vin)
100Hz			
200Hz			
.....			
1KHz			
2KHz			
.....			
10KHz			
20KHz			
.....			
100KHz			
200KHz			
1MHz			

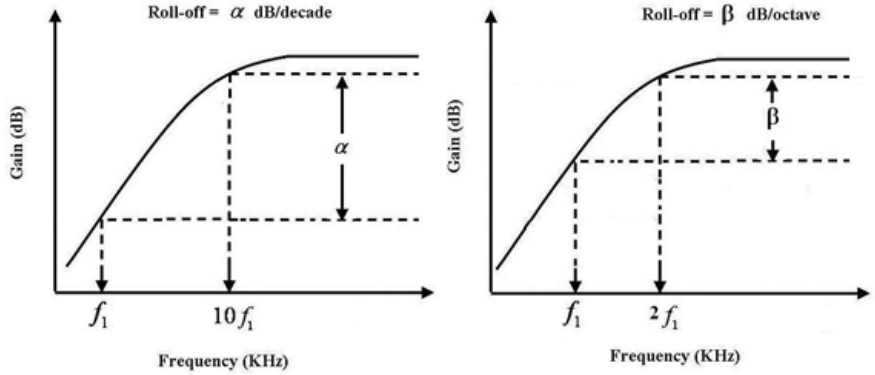
Step 6

Plot the frequency response of the designed filter (Plot of Frequency Vs. Gain on a semi-log sheet), and hence obtain the cut-off frequency



Step 7

Compute the Roll-off factor of the designed filter (The ideal value of roll-off factor is + 40dB/decade or +12dB/octave)



Step 8

Observations:

i) The designed filter has a cut-off frequency ……Hz
ii) The designed filter has a roll-off factor …….. dB/decade

Step 9

Open-ended Question / Can you answer this?

What will be the result if:
1) We repeat the frequency response readings for Passive High Pass Filter. How does it compare Active High Pass Filter
2) We sketch the frequency response of the passive and active second order HPF on the same graph sheet. What is the observation?