# MASSACHUSETTS INSTITUTE OF TECHNOLOGY
22.071/6.071 Introduction to Electronics, Signals and Measurement
Spring 2006

Laboratory 13. Filters

Exercise 1.

For this exercise we will use a prepared LabView instrument called **Filters.vi** which you may download from the class web site. Also you will need to use the sound file of a piano note called **PianoC.wav** which you may also download from the class web site.

The amplitude of the signal and its Fourier transform are shown below.
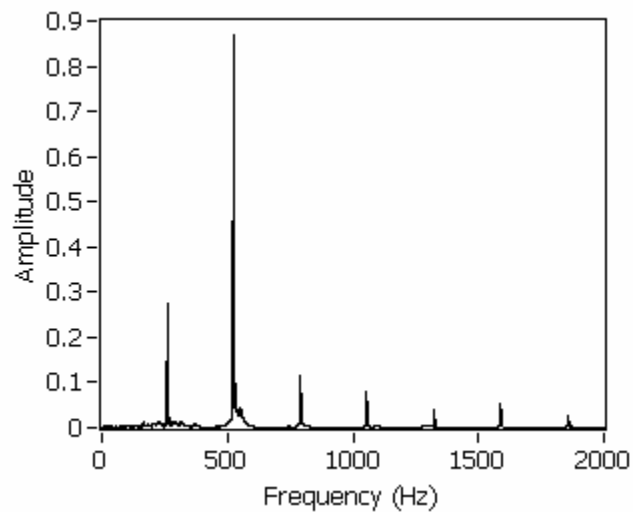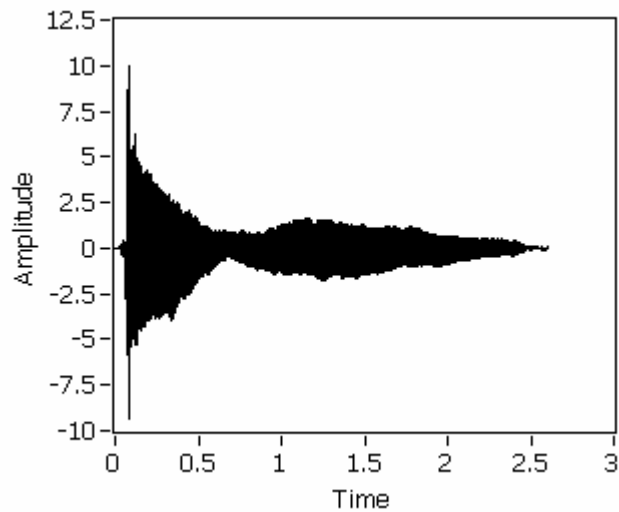
For this exercise you are asked to do the following:

a) Starting with the fundamental RC circuit determine the values for R, and C needed in order to design a **Low Pass** and a **High Pass** filter with a cutoff frequency f_0 of 650Hz, and 400Hz.

For $f_0 = 650Hz$, $C =$ $R =$

For $f_0 = 400Hz$, $C =$ $R =$

Draw the circuit and show your input and the output ports

b) Now you will test your circuit by building it on your protoboard and testing it.

The input signal is available at the pin called DAC0.

Connect your output to ACH0+ and ACH0-.

Run the program called **Filters.vi.** Start the instrument and observe the results for both the **Low Pass** and the **High Pass** filter designs ($f_0 = 650Hz$ and $f_0 = 400Hz$)

Do your results agree with your predictions?

A good thing to do here is to use a variable resistor in place of R in your circuit. Vary it and observe the results.

Exercise 2.

Now you will design and test a **Band Pass** filter using again the RLC circuit arrangement.

The central frequency for this filter is to be at 3,400Hz. For the resistor in your circuit use a variable resistor and work again with your 47mH inductor.

Determine the required capacitance.

Draw the circuit indicating the input and output ports and the element values.

Draw the general form of the transfer function

Build your circuit and connect the input to DAC0 and the output to ACH0+ and ACH0-. Download the instrument **Filter2.vi** from the class web site. Run the program **Filter2.vi** and observe the results. How does the frequency spectrum changes as you trim the potentiometer?

Exercise 3.

For this final exercise you will design and test a **Band Stop** filter using again the RLC circuit arrangement.

a) Design the **Band Stop** filter with a center frequency of 2500Hz. Use your 47mH inductor and calculate the value of the other parameters. Show your circuit below indicating the input and output ports and the element values.

Draw the general frequency response of your filter below.

b) Build your circuit and connect the input to DAC0 and the output to ACH0+ and ACH0-. Run the instrument **Filter2.vi** and observe the results. Adjust your values to try to center the band stop at the requested frequency. Do these results agree with your expectations?