Lab 3 Filtering technique

Objectives:

After this exercise you should be able to build analogue antialiazing filters and implement digital filters on a microcontroller. You should also get knowledge about design and analysis of different kind of filters.

N.B

Always check the input voltage to the microcontroller A/D. It should be between 0-3,3 V. No more!

Exercise:

1.Start with your passive lowpass filter.
What sampling frequency f_s are you using and what cutoff frequency f_c have chosen?

2.Test the filter itself with a frequency generator. Put sinusoidal signals into the filter. Measure (as you learned in Lab1) with oscilloscope before and after the filter. What cutoff frequency can you measure? How is that compared to your theoretical f_c ? What phase delay do you get?

3.Connect your filter to the controller N.B. Be aware of the signal level so you don't break the A/D converter! and put a sinusoidal signal with $f_c/5$ into the filter. Send the data to the PC and plot your signal in matlab. What can you see? What amplitude do you measure compared to the function generator output?

4.Raise the input frequency to f_c. How does your sampled signal look now?

5.Raise the input frequency to $5*f_c$. How does your sampled signal look now?

6.Use the active first order filter. Use the same cutoff frequency for this filter as before. Do not connect it to your microcontroller yet! Try it with sinusoidal input and look for the cutoff frequency with an oscilloscope. What frequency do you get? What phase delay do you get?

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7. Connect the active filter as a lowpass filter for your controller, instead of the passive one. Use a frequency generator, with the same frequency and amplitude as in 3, as input. What amplitude do you get compared to the passive filter.

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8. Design and implement a digital lowpass filter with cutoff frequency of 200 Hz. You will have good usage of the filter-lecture material. Make sure you have the right voltage levels 0-3,3 V from a frequency generator and use a square wave of 100 Hz as output. What will you see in the plot?

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9. Make a second order digital lowpass filter with 200 Hz of cutoff frequency. Use 100 Hz square wave as input signal.
What do you see in the plot?

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10. Design a highpass filter with cutoff frequency of 600 Hz. Use the same input as before. What do you see now?

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11. Extra extra... Send both unfiltered + filtered signal to matlab. Compare.

This it it!