LAB3	SIGNAL FILTERING
	points: 15 hours: 4

Objectives

1. To know the different types of digital filters.
2. To implement FIR and IIR filters and demonstrate the effect of filtering on example signals.

Exercise 3.1 [1 point]

Answer the following questions:

a. What is the step response of an LTI system?
b. What is filter kernel?
c. Give classification of filters and brief description of each class.
d. Describe the Overlap-Add method.

Exercise 3.2 [3 points]

Given three filters described by the following difference equations:

1) y[n]=0.41x[n] + 0.8y[n-1] - 0.24y[n-2] + 0.032y[n-3] - 0.002y[n-4]
2) y[n]=0.93x[n] – 0.93x[n-1] + 0.86y[n-1]
3) y[n]=0.32x[n] + 0.68y[n-1]

Answer the following questions (for each filter):

a. Is it FIR or IIR filter? Is it high-pass or low-pass filter?
b. Determine filter's cutoff frequency.

Exercise 3.3 (CODE) [3 points]

Write code that filters an input signal using MATLAB functions *filter(), fir1(), fir2(), remez()*. Your filter should be low-pass with cutoff frequency *fc=f1*. Save filtered signal to WAVE file. Plot the spectrograms of signal before and after filtering.

Exercise 3.4 (CODE) [4 points]

Open MATLAB Filter Design & Analysis Tool. Design low-pass FIR filter with cutoff frequency *fc=f1*. Write code that applies the designed filter using the Overlap-Add method. Write code that applies the designed filter using the Overlap-Save method. Save filtered signals to WAVE files. Plot the spectrograms of each signal before and after filtering.

Exercise 3.5 (CODE) [4 points]

Open MATLAB Filter Design & Analysis Tool. Design low-pass IIR filter with cutoff frequency *fc=f1*. Write code that directly implements in time-domain filter you've designed. Save filtered signals to WAVE files. Plot the spectrograms of each signal before and after filtering.