

Multirate Signal Processing

Seminar 2

To be presented:

even week – 28.05.20

odd week – 04.06.20

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Homework assignment

Improve the filters from Homework 1:

- a) Design new filters using the window design method and modulation (**The bandwidth of all filters has to be the same**)
- b) Further improve the filters by changing the window shape (window types)
- c) Conclude, if we still have perfect reconstruction → Back to time-domain
- d) Plot in the same figure Original signal and Reconstructed signal **on top of each other to see the difference** (pay **attention** to the normalization - the amplitudes of both signals have to be the same)

Homework assignment

How to design new filters

- the impulse response of an ideal low pass filter is known (lecture 4)
- the impulse response of the ideal high pass can be determined by following: start with the ideal frequency domain formulation, take the inverse DTFT
- the goal is to obtain a causal finite impulse response filter from the ideal lowpass/highpass infinite impulse response
- Apply rectangular window (of length 10 taps) to LP and HP filters (Lecture 5)
- To achieve BP filters use Modulation (Lecture 6)

Homework assignment

- compute and plot the resulting frequency responses of your new filters.
- Apply these filters to you signal

Presentation order

- Plot frequency responses of LP filters using different Window types on top of each other to see the difference (which Window type is better?)
- Plot frequency responses of all the modulated filters on the same plot (filterbank) for the best window type.
- For frequency response plots (**For all the home works!!**):
 - x-axis has to be either normalized to π or show the real frequency range (**not the sequential number of plotted sample**)
 - y-axis has to be **magnitude in dB**.
- Plot in the same figure Original signal and Reconstructed signal **on top of each other to see the difference** (pay attention to the normilization - the amplitudes of both signals have to be the same)
- For the plots with several signals – **a legend is required**

Example of how your plots have to look like:

