Multimedia Signal Processing 1st Module

6 /7/2011

Ex.1 (Pt.10)

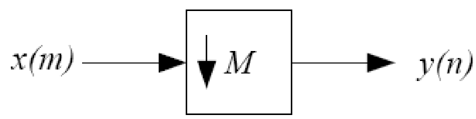
Consider the following filter $H_1(z)$, it is applied to a signal sampled at 200 Hz.

$$H_1(z) = \frac{1 - z^{-4}}{1 + z^{-1}}$$

1. What kind of filter is it? Explain why it could be useful to remove power supply noise at 50 Hz.
2. If the input signal is $x(n) = 5\cos(2\pi \cdot 100 \cdot n)$ what will be the amplitude of the output?
3. Define the impulse response *h(n)* of the filter.

Ex.2 (Pt.10)

Describe the downsampling of an order of 4 of a signal: (where M=4).



1. If the original signal spectrum extends from $-\pi/3$ to $\pi/3$ (in normalized frequencies) draw the final spectrum after downsampling (quoting both axes).
2. How can be avoided aliasing? Describe the optimal decimation chain for this case.

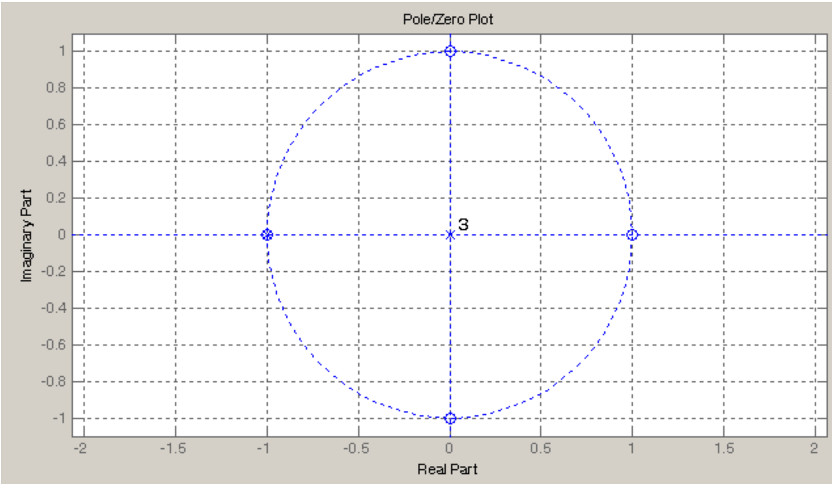
Ex.3 (Pt.10) MATLAB

1. Load the waveform 'voiced_a.wav' and determine the sampling frequency Fs.
2. Consider a LTI digital filter characterized by the following difference equation:
   h(n) = -0.99 y(n-1) + x(n)
3. Compute its impulse response for $0 \le n \le 1000$.
4. Filter the input sequence x(n) with h(n) computing the convolution by means the OLA approach: segment the signal x(n) into overlapping frames of length 40ms using a Bartlett window at 50% overlap.

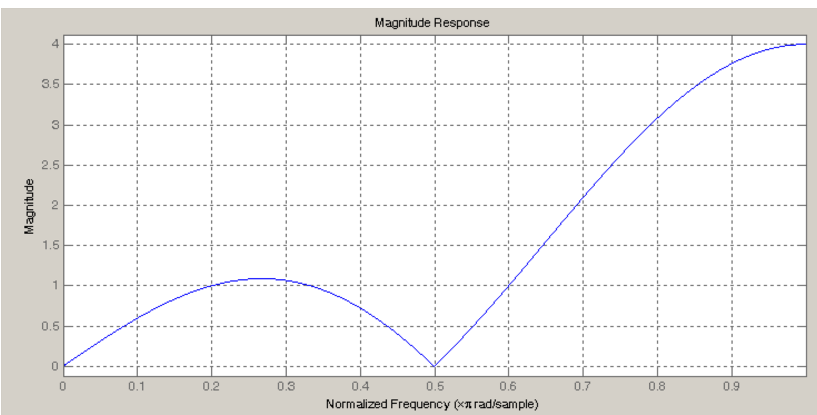
Solutions

Ex.1:

The zeros-poles diagram is:



The amplitude response is:



The impulse response is: