Multimedia Signal Processing 1st Module

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Ex.1 (Pt.12)

Consider the filter *A*(*z*) which is the cascade of two filters: $B(z)=\frac{1}{1-4z^{-2}}$ and $C(z)=\frac{1+\frac{1}{2}z^{-1}}{1-2z^{-1}}$

1. Define the *z*-transform of the filter A(z) and draw the zeros-poles diagram of it.
2. Is the resulting filter stable? If not define a new filter A'(z), stable, that presents the same amplitude response. Find also the gain G for the filter A'(z) in order to have the same amplitude response of A(z).
3. Define the phase values for $\omega=0,\pi/2,\pi,-\pi/2$ for both filters A(z) and A'(z). In case of discontinuities indicate the range of the gap.
4. Provide an approximate representation for the filters amplitude response.

Ex.2 (Pt.9)

A sequence of white Gaussian noise samples filtered by an unknown filter gave the following values:

[2|-1|-2|0].

1. Estimate the first 3 samples of the correlation function
2. Approximate the unknown filter by an AR process of ofder 1: use Yule-Walker to estimate the pole position and the power of the white noise.

Ex.3 (Pt.12)

Build a signal sum of three different sinusoids sin(2πft) at the radian frequencies w1= π/8, w2=π/10 w3= π/3. The signal is defined over a temporal axis of 512 samples. (Assume that the sampling period T=1).

Decimate the signal by a factor M=4 using the Matlab function 'fir1' for desi gning the filter, but not the function 'decimate'.