May 11, 2021

EE 433 Intro. to DSP, Computer HW Part#2
(due to June 7, 2021)

NOTE: For plotting the amplitudes in **time**-domain, use **LINEAR** scale. For plotting the amplitudes in **frequency**-domain use **LOGARITMIC** scale.

5. Starting from your solution in question 1 of Computer HW Part #1 and using the frequency transformations of low-pass filters described in ed. 3 of the textbook (pp.526-532, section 7.4), design a high-pass filter with cut-off frequency $\omega_p = 0.7\pi$:

   (a) Give the system function, $H(z)$, of the designed filter.

   (b) Plot the magnitude of frequency response, indicating the corner frequencies corresponding to passband and stopband amplidute design targets given in (1).

6. Starting from your solution in question 1 of Computer HW Part #1 and using the frequency transformations of low-pass filters described in ed. 3 of the textbook (pp.526-532, section 7.4), design a band-pass filter with cut-off frequencies $\omega_{p_1} = 0.3\pi$ and $\omega_{p_2} = 0.5\pi$:

   (a) Give the system function, $H(z)$, of the designed filter.

   (b) Plot the magnitude of frequency response, indicating the corner frequencies corresponding to passband and stopband amplidute design targets given in (1).

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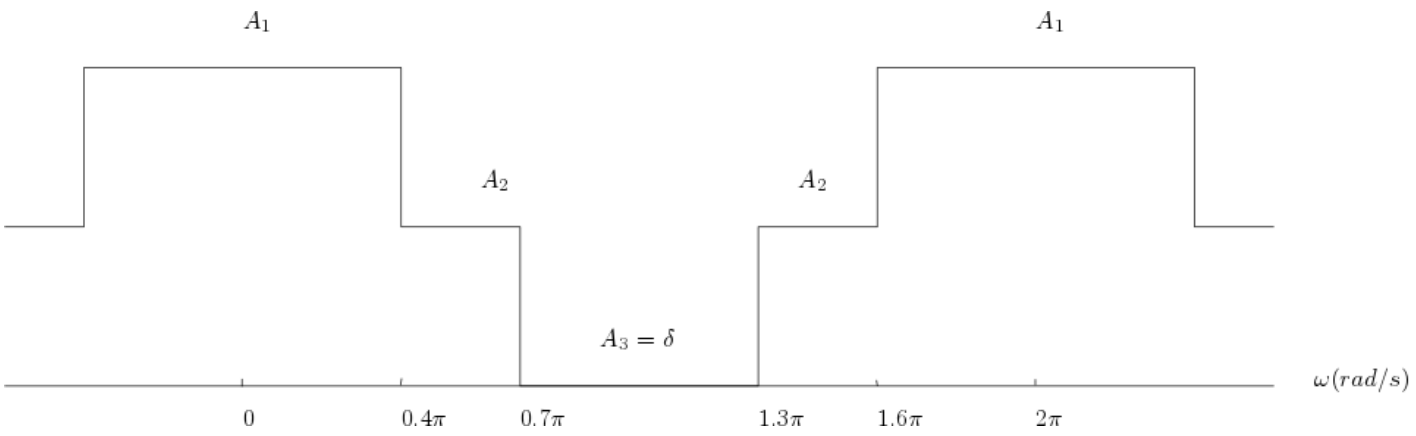
7. Consider the DTFT shown below. That ideal filter will be approximated using a Kaiser window. The parameters of the design are $A_1/A_2 \geq 15$ dB and $A_2/A_3 \geq 25$ dB. Additionally, each transition band is not wider than 0.1π, that is the separation of successive critical frequencies obey the rule: $|\omega_i - \omega_{i+1}| \leq 0.1\pi$

   (a) Give the formula of $h[n]$, the impulse response of the DT-filter.

   (b) Plot $h[n]$.

   (c) Plot the magnitude of the frequency response of the designed DT-filter. Check the gains at the critical frequencies.



8. A signal is defined as

$$x[n] = \cos(2 * \pi * 0.3 * n) \qquad \text{for} \quad n = 1, 2, \ldots, 15.$$

Interpolate in time domain by a factor of 4 using zero padding in frequency domain. Plot all of the signals including every intermediate step in this procedure.

Instructions:

- Submit as a pdf-file report.
- Show your work. Give intermediate results where you think it useful.
- Also supply computer routines in an appendix.