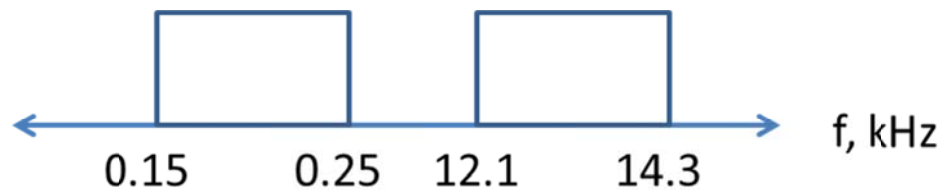


In Class Problem

BiLinear Transform

Given: An incoming analog audio signal is bandlimited from 0 to 20 kHz and then sampled with a 16-bit linear ADC with an $F_s = 44.1$ kHz. You are to design two IIR Band Pass Filters using the BiLinear Transform method. The ideal specs are:



Step 1: Find an appropriate $H(s)$ for a BPF from your analog filter cookbook. After hours of searching you decide to use this filter:

$$H(s) = \frac{1}{\frac{s^2 + w_{c1}w_{c2}}{(w_{c2} - w_{c1})s} + 1}$$

Step 2: Prewarp: warp your ideal cutoff frequencies you want in the Z-plane back to where they lie in the S-plane. Use this handy-dandy table...

f_c (kHz)	$\Phi_c =$	$w'_c =$	$f'_c =$
0.15			
0.25			
12.1			
14.3			

Step 3: Design the prewarped analog filter $H'(s)$

[just do the left BPF]

Step 4: Find $H(z)$ using the BZT.

[just do the left BPF]

$$H(z) = H'(s), \text{ letting } s = \frac{2}{T} \left(\frac{1 - z^{-1}}{1 + z^{-1}} \right)$$

Step 4, an alternative method (using poles and zeros)...: