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Course Title: EC516 DSP

Implementing a polyphase uniform DFT filterbank

Objective:

To study the implementation of a 2 channel DFT filter bank with h[n] = [1,1,1,1] in order to appreciate its computational efficiency over implementing separate filters.

Procedure:

Step 1: Deriving a 2 channel DFT filter bank

We know that h[n] = [1,1,1,1] and since M = 2:

$H_0(z) = E_0(z^2) + z^{-1}E_1(z^2)$

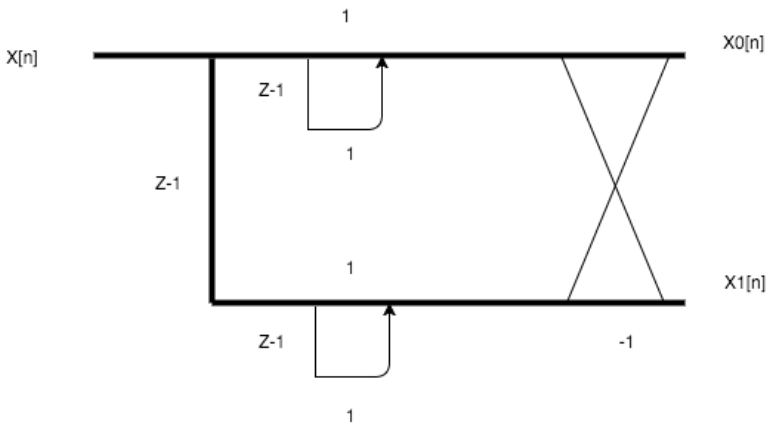
$e_0[n] = h_0[2n]$

$e_1[n] = h_0[2n+1]$

$E_0(z^2) = 1 + z^{-2}$

$E_1(z^2) = 1 + z^{-2}$

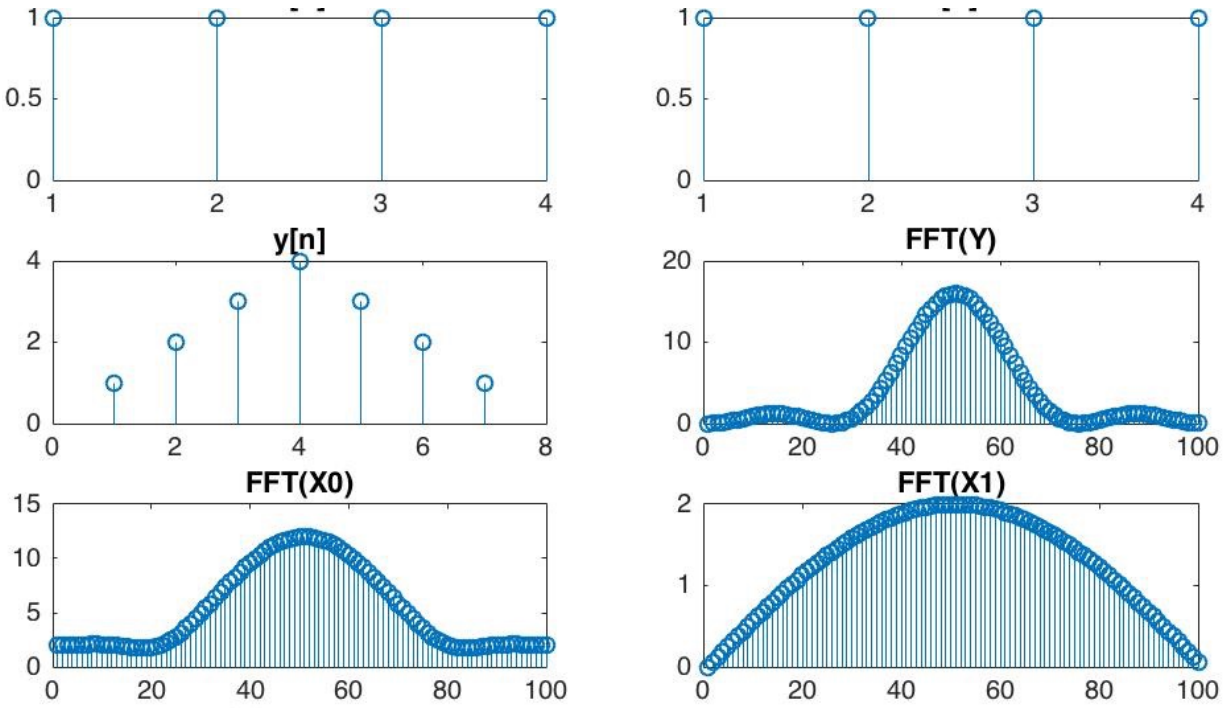
$H_0(z) = 1 + z^{-2} + z^{-1}(1 + z^{-2})$



2 channel uniform DFT filterbank implementation

Step 2: Implementing the filter

I first created the signal h[n] in matlab and x[n] = [1,1,1,1] as the test signal and computed the convolution y after which i implemented the filters E0 and E1. A delay filter z was also created. The outputs at Node 0 and Node 1 were computed (right before the cross in the flow diagram towards X0 and X1 respectively.) With these values X0[n] and X1[n] were found. The following figure show my results:



As we can see, the result of the convolution between the signal and the filter is a triangular function which is a sinc in the frequency domain. The two outputs X0 and X1 obtained from the polyphase uniform filter bank are seen here

Conclusions:

The 2 channel polyphase implementation of the DFT filter bank was successful and the output X0 and X1 was computed efficiently by reusing filter elements through this implementation. The code was later hosted on GitHub: https://github.com/adarshmammen/Polyphase-DFT-filter-bank---2-Channel