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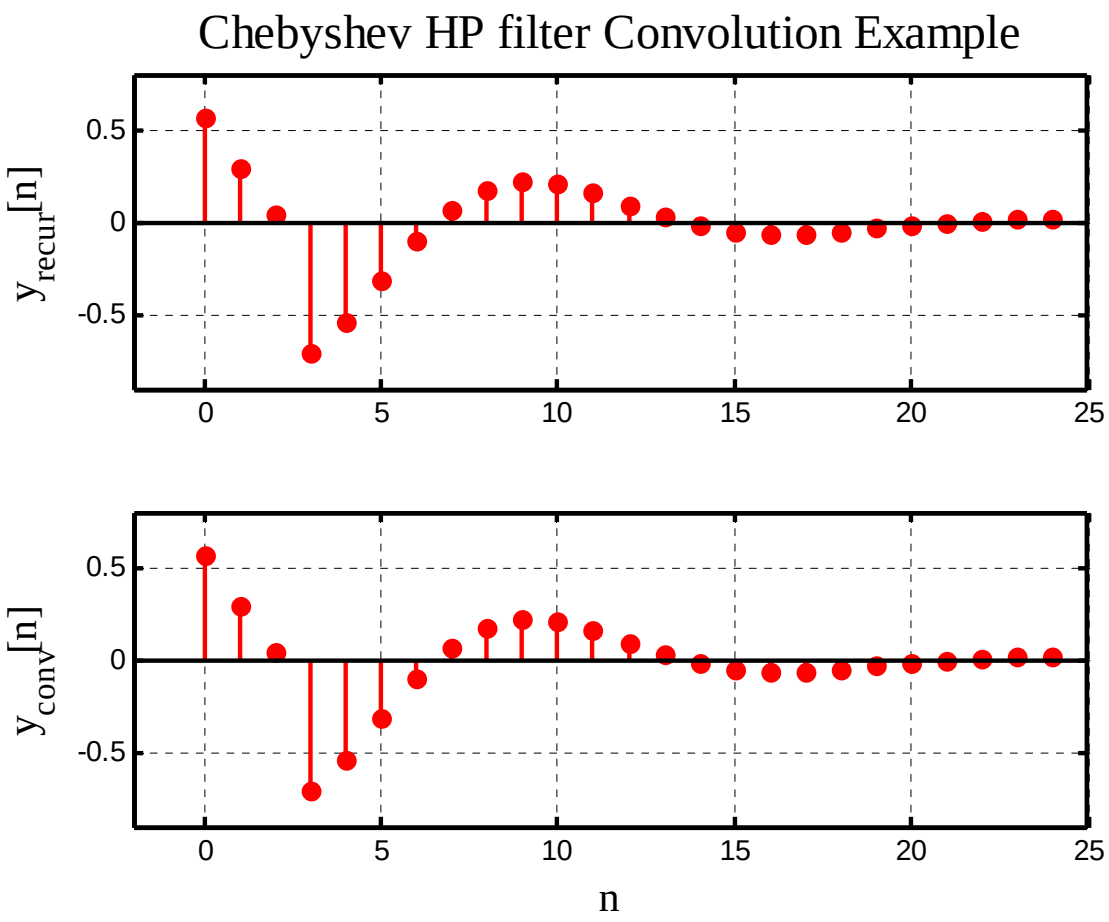
% Convolution Example(chap2_DT_convolution.m)
%   Find the convolution response for a Chebyshev
%   Type 1 HP filter (IIR)to a rectangular pulse input.
% Difference equation-
%  y[n]-1.516y[n-1]+0.703y[n-2]=0.57x[n]-1.14x[n-1]+0.57x[n-2]
% Initial conditions-
%  y[-1]=y[-2]=x[-1]=x[-2]=0
% Input is a rectangular pulse three steps long-
%  x[n]=p3[n-1]=delta[n]+delta[n-1]+delta[n-2]
%
a=[-1.516, 0.703];
b=[0.57,-1.14,0.57];
n=0:24;
% Define 3 input vectors, each a weighted & time-shifted impulse
function
x_0=zeros(1,length(n)); x_0(1)=1;
x_1=zeros(1,length(n)); x_1(2)=1;
x_2=zeros(1,length(n)); x_2(3)=1;
% For comparison, define the input as a single vector
x=zeros(1,length(n));x(1)=1;x(2)=1;x(3)=1;
%stem(n,x_0,'r.') % check inputs
x0=[0,0];
y0=[0,0];
% Compute the output using the convolution representation
y_0=recur(a,b,n,x_0,x0,y0);
y_1=recur(a,b,n,x_1,x0,y0);
y_2=recur(a,b,n,x_2,x0,y0);
y_conv=y_0+y_1+y_2;
% Compute the output using direct recursion
y_recur=recur(a,b,n,x,x0,y0);
subplot(211),stem(n,y_recur,'r.'),axis([-2 25 -0.9 0.8]),
ylabel('y_{recur}[n]','fontsize',14,'fontname','times'),
%xlabel('n','fontsize',14,'fontname','times roman'),
title('Chebyshev HP filter Convolution
Example','fontsize',16,...
    'fontname','times'),
grid;
subplot(212),stem(n,y_conv,'r.'),axis([-2 25 -0.9 0.8]),
ylabel('y_{conv}[n]','fontsize',14,'fontname','times'),
xlabel('n','fontsize',14,'fontname','times'),
grid;
set(findobj('type','line'),'linewidth',1.5)
set(findobj('type','line'),'markersize',18)
set(findobj('type','axes'),'linewidth',2)
```


Chebyshev HP filter Convolution Example
$y_{recur}[n]$
$y_{conv}[n]$
0.5
0
-0.5
0
5
10
15
20
25
n