MATLAB Code

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%Experiment 4:                                    Date: 19/02/2020
%Overlap Save and Overlap Add Approach

%overlap_add.m
function out = overlap_add(x,h)
m = length(h);
l = power(2,m);
n = l-m+1;
h = [h zeros(1,n-1)];
N = length(x);
a = mod(N,l);
if(a~=0)
    x = [x zeros(1,l-a)];
end
N = length(x);
y = [];

for i = 1:l:N
    if(i==1)
        xi = [x(i:n) zeros(1,m-1)];
    else
        xi = [x(i-(m-1):i+n-m) zeros(1,m-1)];
    end
    Xi = fft(xi);
    H = fft(h);
    Yi = Xi.*H;
    yi = ifft(Yi);
    if(i==1)
        y = [y yi];
    else
        y = [y(1:length(y)-(m-1)) y(length(y)-(m-1)+1:length(y))+yi(1:m-1)
yi(m:length(yi))];
    end

end
out = y(1:length(y)-(m-1));


%overlap_save.m
function out = overlap_save(x,h)
m = length(h);
l = power(2,m);
n = l-m+1;
h = [h zeros(1,n-1)];
N = length(x);
a = mod(N,l);
if(a~=0)
    x = [x zeros(1,l-a)];
end
N = length(x);
y = [];
x = [zeros(1,m-1) x];
for i=1:l:N
    if(i==1)
        xi = x(1:l);
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    else
        xi = x(i-(m-1):n+i-1);
    end
    Xi = fft(xi);
    H = fft(h);
    Yi = Xi.*H;
    yi = ifft(Yi);
    y = [y yi(m:length(yi))];
end
out = y;

%main.m

clc;
clear all;
close all;

x = [3 0 -2 0 2 1 0 -2 1 0 3 0 -2];
h = [2 2 1];

y1 = overlap_save(x,h)
y2 = overlap_add(x,h)
y3 = cconv(x,h);
y3 = y3(1:length(x)-1)
figure();
subplot(121);
stem(x);title "Signal";xlabel n;ylabel x[n]
subplot(122);
stem(h);title("Impulse Response");xlabel n;ylabel h[n]
figure();
subplot(131);
stem(y1);title("Circular Convolution using Overlap Save");xlabel n; ylabel
y[n];

subplot(132);
stem(y2);title("Circular Convolution using Overlap Add");xlabel n; ylabel
y[n];

subplot(133);
stem(y3);title("Circular Convolution using CCONV Function");xlabel n; ylabel
y[n];

if(round(y1) == round(y2))
    if(round(y2) == round(y3))
        if(round(y3) == round(y1))
            disp("Circular Convolution correct")
        end
    end
end
```

RESULT

```
y1 =

  Columns 1 through 5
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```
    6.0000    6.0000   -1.0000   -4.0000    2.0000

  Columns 6 through 10

    6.0000    4.0000   -3.0000   -2.0000   -0.0000

  Columns 11 through 12

    7.0000    6.0000

y2 =

  Columns 1 through 5

    6.0000    6.0000   -1.0000   -4.0000    2.0000

  Columns 6 through 10

    6.0000    4.0000   -3.0000   -2.0000   -0.0000

  Columns 11 through 12

    7.0000    6.0000

y3 =

  Columns 1 through 5

    6.0000    6.0000   -1.0000   -4.0000    2.0000

  Columns 6 through 10

    6.0000    4.0000   -3.0000   -2.0000    0.0000

  Columns 11 through 12

    7.0000    6.0000

Circular Convolution correct
```