Experiment No: 8 Date: 07/10/2024

OVERLAP ADD AND
OVERLAP SAVE METHOD

Aim

To perform Linear Convolution of two sequences using :-

1. Overlap Add Method
2. Overlap Save Method

Theory

The **Overlap-Add (OLA)** method is a technique used in signal processing, particularly for efficient computation of long convolutions. It is often applied when you need to convolve a signal with a filter, but the filter length makes direct computation computationally expensive or infeasible.The basic idea is to break down the convolution into smaller, more manageable chunks, process each chunk separately, and then combine them using an "overlap" approach. This method is widely used in applications such as audio processing, speech processing, and more. Splits the signal into overlapping blocks, applies the FFT to each block, and sums the results. The overlap happens in the time domain after the IFFT is applied.

The **Overlap-Save (OLS)** method is another technique used in signal processing to efficiently compute convolutions, particularly when working with long signals and FIR filters. Like the **Overlap-Add** method, the goal of the Overlap-Save method is to break down a long convolution into smaller, manageable chunks to make use of the **Fast Fourier Transform (FFT)**, thereby speeding up the process and reducing computational complexity. Also splits the signal into blocks, but the overlap occurs in the frequency domain before applying the IFFT. The key idea is that the overlap in the time domain is discarded, and only the non-overlapping part is retained.

OBSERVATION

1. **INPUT=**

Enter first sequence values=[1 2 3 4 5 6 7 8 9 10]

Enter second sequence values=[1 1]

OUTPUT=

Columns 1 through 5

1.0000 3.0000 6.0000 9.0000

Columns 6 through 10

15.0000 18.0000 21.0000 24.0000 27.0000

Columns 11 through 12

19.0000 10.0000

Program

1. Overlap Add Method

```
clc;
clf;
close all;
clear all;
x=input ('enter first sequence values=');
h=input ('enter second sequence values=');
h1=length(x);
h2=length(h);
x=[x,zeros(1,h2)];
if (h1>h2)
    s=[zeros(1,h1+(2*h2)-1)];
    for (i=1:h2:h1)
        a=x(i:i+h2-1);
        s1=convdft(a,h);
        s(i:i+(2*h2)-2)=s(i:i+(2*h2)-2)+s1;
    end
end
y=s(1:h1+h2-1);
disp (y);
function h=convdft(x,y)
       n1=length(x);
       n2=length(y);
       x=[x,zeros(1,n2-1)];
       y=[y,zeros(1,n1-1)];
       dx=fft(x);
       dy=fft(y);
       mul=dx.*dy
       h=ifft(mul);
end
```

OBSERVATION

2. INPUT=

Enter first sequence values=[1 2 3 4 5 6 7 8 9 10]

Enter second sequence values=[1 1 1]

OUTPUT=

Columns 1 through 5

1.0000 3.0000 6.0000 9.0000 12.0000

Columns 6 through 10

15.0000 18.0000 21.0000 24.0000 27.0000

Columns 11 through 12

19.0000 10.0000

Program

2. Overlap Save Method

```
clc;
clf;
close all;
clear all;
x=input ('enter x values=');
h=input ('enter h values=');
l1=length(x);
l2=length(h);
h=[h,zeros(1,l2-1)];
x=[zeros(1,l2-1),x,zeros(1,l2)];
y=[];
for i=1:l2:l1+l2-1
    x1=x(i:min(i+2*l2-1,end));
    if length (x1)<2*l2;
        x1=[x1,zeros(1,2*l2-length(x1))];
    end
    s1=convdft(x1,h);
    y=[y,s1(l2:2*l2-1)];
end
y=y(1:l1+l2-1);
disp('The result of the convolution is:');
disp (y);
function h=convdft(x,y)
       n1=length(x);
       n2=length(y);
       x=[x,zeros(1,n2-1)];
       y=[y,zeros(1,n1-1)];
       dx=fft(x);
       dy=fft(y);
       mul=dx.*dy
       h=ifft(mul);
end
```

Result

Performed Linear Convolution of two sequences using Overlap Add and Overlap Save Method.