Heaven's Light is Our Guide

Rajshahi University of Engineering& Technology

Department of Electrical & Computer Engineering

Course No: ECE 4124
Course Name: Digital Signal Processing Sessional

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Experiment Name: Calculation and representation of auto-correlation and cross-correlation using MATLAB.

Theory: A correlation can be thought of as a means to gauge how similar two items are. Two things have a strong correlation if they are substantially similar.

Convolution and correlation have comparable properties, although correlation is easier. Two functions are compared in correlation to see if they are similar. This is distinct from convolution, which seeks a correlation between two functions' signals and responses.

$$\mathrm{Corr}(p, q) = \int_{-\infty}^{\infty} p(\tau + t)q(\tau)d\tau$$

Autocorrelation means comparing a function with itself. Correlation uses same math and numbers as other techniques. The Weiner-Khinchin Theorem is a rule that explains something.

$$\mathrm{Corr}(p, p) \leftrightarrow |P(\omega)|^2$$

Code:

Autocorrelation:

```
clc;
clear all;
close all;


x=[1 2 -1 -3 2 2 5 6 2];
subplot(3,1,1);
stem(x);
title('Signal x(n)');


len=length(x);
sz=len+2*(len-1);
y = zeros(1,sz);


s = len;
for i=1:len
    y(s)=x(i);
    s=s+1;
end;


z = zeros(1,sz);
for i=1:len
    z(i) = x(i);
end;
```

```
val=0;
sig=[];
for i=1:len+len-1
    for j=1:sz
        val=val+y(j)*z(j);
    end;
    sig(i)=val;
    val=0;
    z=circshift(z,[0 1]);
    z(1)=0;
end;


subplot(3,1,2);
stem(sig);
title('Correlated Signal');


subplot(3,1,3);
sig1= xcorr(x);
stem(sig1);
title('Correlated Signal using built in function');
```

Output:

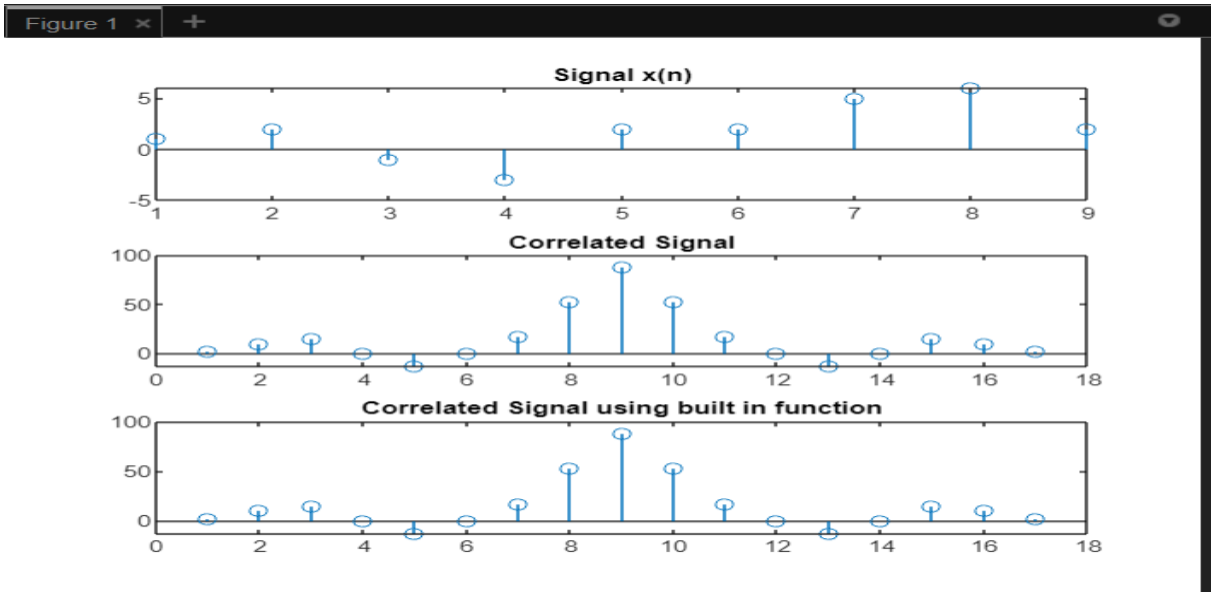

Fig 1: Result of plotting auto correlation.

Discussion: We investigated the relationship between two distinct signals in our study. We investigated the relationship between a signal and a delayed version of itself. The relationship between two signals was then examined. Regardless of whether we used the built-in function or came up with the solution on our own, we always received the same result.

Conclusion: The experiment went off without a hitch, and neither the computer instructions nor the images had any issues.