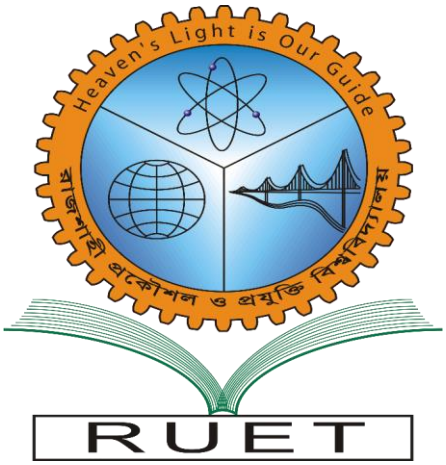
Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology



Department of Electrical & Computer Engineering

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

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Experiment No: 04

Experiment Name: Identification of Signal Delays and Periodocity using correlation.

Theory:

Signal delay identification in DSP refers to the process of determining the time delay between two or more signals. It involves finding the amount of time by which one signal is shifted or delayed with respect to another signal.
Identifying signal delays is crucial in various applications, such as time synchronization, audio and video processing, communications, radar systems, and more.
Periodicity refers to the property of a signal that repeats itself after a certain interval of time, called the period. In Digital Signal Processing (DSP), determining the periodicity of a signal is important for various analysis and processing tasks.

Code:

Identifying Delays:

```
clc
clear all
close all
fs=1000
t = 0:0.001:1;
frequency = 10;
dutyCycle = 50;
delay = 0.15;

signal = square(2*pi*frequency*t, dutyCycle);
subplot(3,1,1)
plot(signal)
title('Given Square Wave')
signalWithDelay = [zeros(1, round(delay*fs)), signal(1:end-round(delay*fs))];
subplot(3,1,2)
title('Delayed Version of the Square Wave')
plot(signalWithDelay)
[correlation, lag] = xcorr(signal, signalWithDelay);
subplot(3,1,3)
plot(lag, correlation)
title('Auto Correlation')
```

Periodicity:

```
clc
clear all
close all

fs = 1000;
t = 0:1/fs:1;
f = 10;
x = sin(2*pi*f*t);

shift_amount = 0.25;
shifted_x = [zeros(1, round(shift_amount*fs)), x(1:end-round(shift_amount*fs))];
autocorr_x = xcorr(x);
autocorr_shifted_x = xcorr(shifted_x);
```

```
15.
16. lags = -length(x)+1:length(x)-1;
17. figure;
18. subplot(4, 1, 1);
19. plot(x);
20. title('Main Signal');
21. subplot(4, 1, 2);
22. plot(shifted_x);
23. title('Shifted Signal');
24. subplot(4, 1, 3);
25. plot(lags, autocorr_x);
26. title('Autocorrelation of Original Signal');
27. 28. subplot(4, 1, 4);
29. plot(lags, autocorr_shifted_x);
30. title('Autocorrelation of Time-Shifted Signal');
31. if autocorr_x(length(x)+1) > 0.9 * max(autocorr_x)
32. disp('Signal exhibits periodicity with a time-shifted version.');
33. else
34. disp('Signal does not exhibit clear periodicity with a time-shifted version.');
35. End
```

Output:

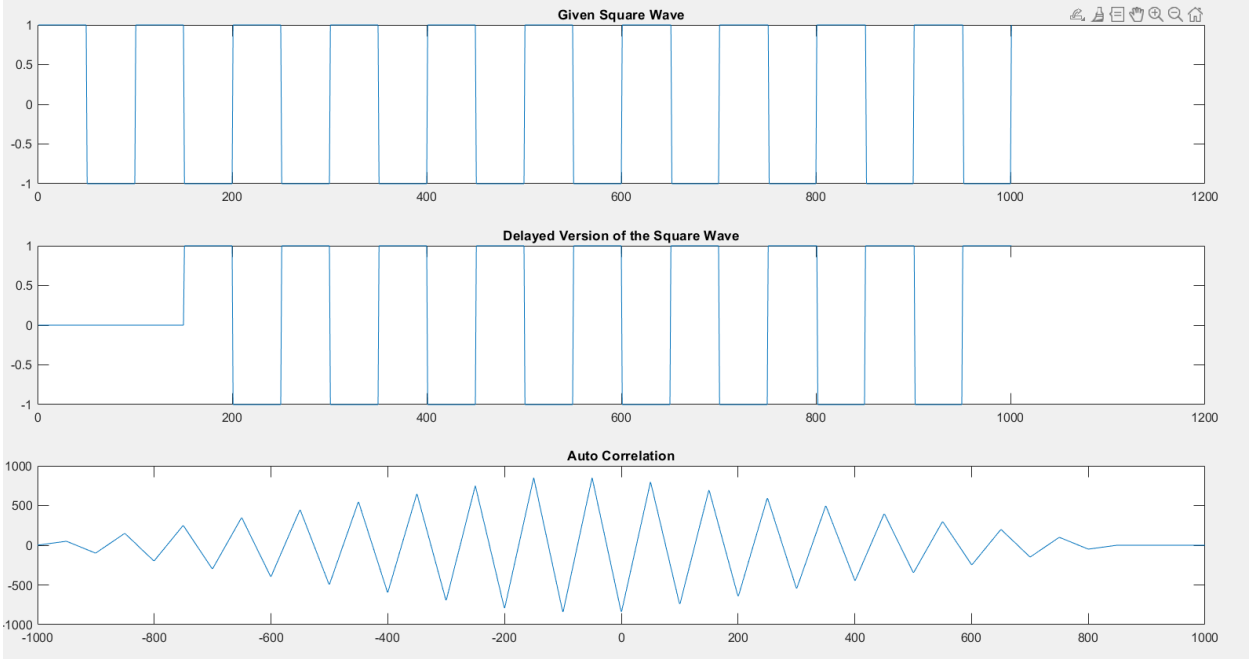

Fig: Identifying delays

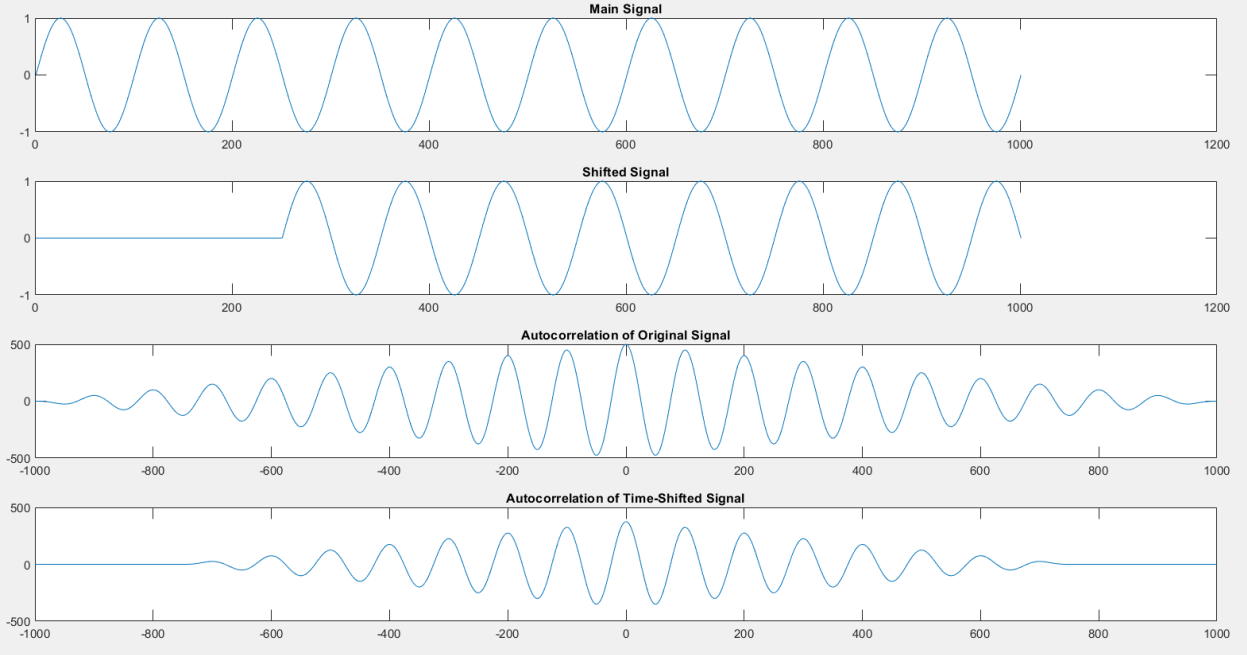

Fig: Periodicity

Discussion:
In this experiment, we learnt how to identify periodicity and delays. We used autocorrelation method for this system.

Conclusion: The code was executed successfully and no errors were found.