AMERICAN INTERNATIONAL UNIVERSITY BANGLADESH

Faculty of Engineering

Laboratory Report Cover Sheet

Students must complete all details except the faculty use part.

Please submit all reports to your subject supervisor or the office of the concerned faculty.

Lab Title: Study of Digital to Analog Conversion using MATLAB

Experiment Number: **06** Due Date: **04 /04/2024** Semester: **Spring 2023-2024**

Subject Code: **COE3103** Subject Name: **DATA COMMUNICATION** Section: **E**

Course Instructor: **NOWSHIN ALAM** Degree Program: **B.Sc. CSE**

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No.	Student Name	Student Number	Student Signature	Date
Submitted by:				
1	**MD. ASHIKUZZAMAN ABIR**	**22-47006-1**		
Group Members:				
2	**MD. SHOHANUR RAHMAN SHOHAN**	**22-46013-1**		
3	**MD. TAHSIN HASIB**	**22-46026-1**		
4	**KHUSHBU ALAM RAHI**	**22-46947-1**		
5	**A. F. M. RAFIUL HASSAN**	**22-47048-1**		

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Introduction: Digital-to-Analog (DAC) is a fundamental process in digital signal processing and communications systems, where discrete digital signals are transformed into continuous analog waveforms. Understanding the principles and techniques of DAC is essential for various applications, including audio reproduction, telecommunications and control systems.

In this experiment, we delve into the realm of DAC through the utilization of MATLAB, a powerful computational tool widely employed for algorithm development and analysis. The primary objective of this experiment is to explore the intricacies of DAC, investigating different DAC architectures, and analyze the performance characteristics of Digital-to-Analog conversion systems.

Theory:

I) Digital to Analog Conversion: Digital to Analog conversion is the process of changing one of the characteristics of an analog signal based on the information in digital data figure that shows the relationship between the digital information, the digital to analog modulating process, and the resultant analog signal.

II) Types of Digital to Analog Conversion:

There are three types of DAC. These are: ASK, FSK and PSK.

ASK (Amplitude shift Keying): In ASK, the amplitude of the carrier signal is varied to create signal elements, where both the frequency and phase remain constant while the amplitude changes.

FSK (Frequency shift Keying): In FSK, the frequency of the carrier signal is varied to represent data. the frequency of the modulated signal is constant for the duration of one signal elements but changes for the next signal element if the data element changes both peak amplitude and phase remain constant for all signal elements.

<u>PSK (Phase shift Keying):</u> In ~~P~~ PSK, the phase of the carrier is varied to represent two or more different signal elements both peak amplitude and frequency remain constant as the phase changes. Today, PSK is more common than ASK or FSK.

there is another modulation, which is called QAM or Quadrature amplitude modulation, which combines ASK and PSK, is the dominant method of digital to analog ~~convert~~ modulation.

ID = AB-CDEFG-H

ID = 22 – 47006 – 1

E = 0 = 00110000

F = 0 = 00110000

G = 6 = 00110110

(a), (b) & (c)

Convert this bit stream to analog signal using the following:

a. 8-ASK: Different amplitudes for 000 to 111 in the modulated signal can be 0 V, 1 V, 2 V, 3 V, 4 V, 5 V, 6 V, and 7 V respectively.
b. 8-FSK: Different frequencies for 000 to 111 in the modulated signal can be 1 Hz, 2 Hz, 3 Hz, 4 Hz, 5 Hz, 6 Hz, 7 Hz, and 8 Hz respectively.
c. 8-PSK: Different phases for 000 to 111 in the modulated signal can be 0, pi/4, 3*pi/4, pi/2, -pi/4, -pi/2, pi, -3*pi/4 respectively.

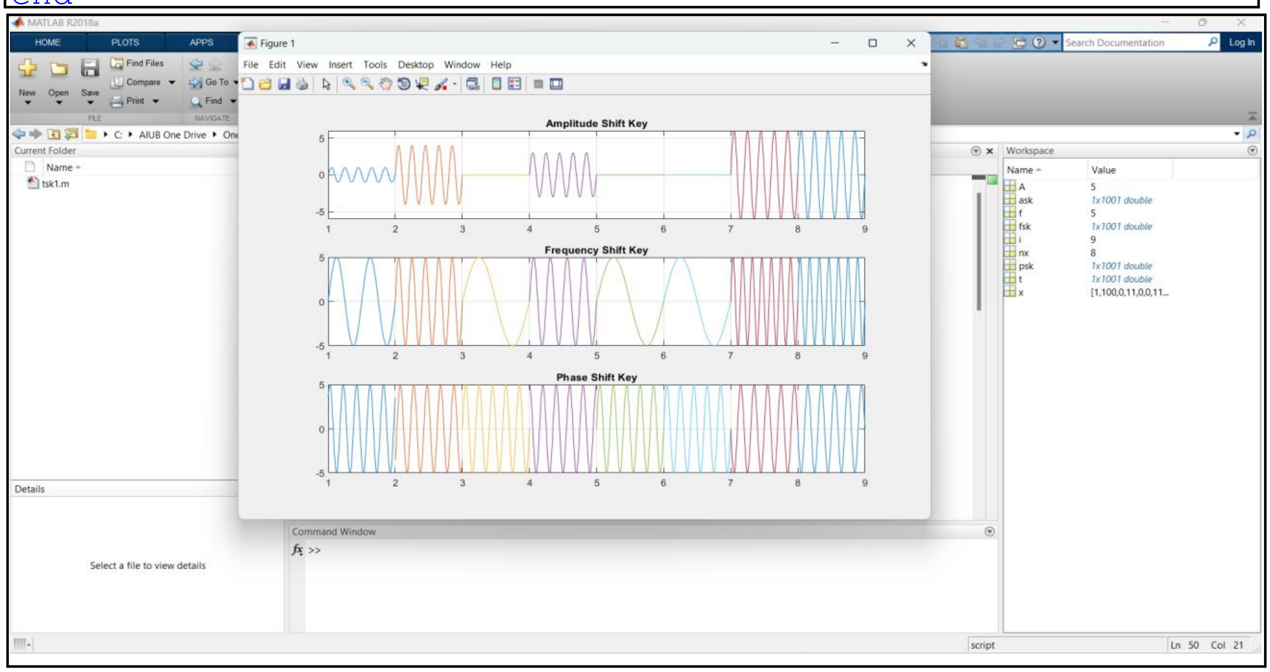
Code & Simulation:

```
close all;
clc;
A=5;
f=5;

x=[001 100 000 011 000 000 110 110]; % input signal ;
nx=size(x,2);

i=1;
while i<nx+1
     t = i:0.001:i+1;
    if x(i)==000
       ask=0*sin(2*pi*f*t);
       fsk=A*sin(2*pi*1*t);
       psk=A*sin(2*pi*f*t+0);
    elseif x(i)==001
       ask=1*sin(2*pi*f*t);
       fsk=A*sin(2*pi*2*t);
       psk=A*sin(2*pi*f*t+(pi/4));
    elseif x(i)==010
       ask=2*sin(2*pi*f*t);
       fsk=A*sin(2*pi*3*t);
       psk=A*sin(2*pi*f*t+(3*pi/4));
    elseif x(i)==011
       ask=3*sin(2*pi*f*t);
       fsk=A*sin(2*pi*4*t);
       psk=A*sin(2*pi*f*t+(pi/2));
    elseif x(i)==100
       ask=4*sin(2*pi*f*t);
```

```
        fsk=A*sin(2*pi*5*t);
        psk=A*sin(2*pi*f*t+(-pi/4));
    elseif x(i)==101
        ask=5*sin(2*pi*f*t);
        fsk=A*sin(2*pi*6*t);
        psk=A*sin(2*pi*f*t+(-pi/2));
    elseif x(i)==110
        ask=6*sin(2*pi*f*t);
        fsk=A*sin(2*pi*7*t);
        psk=A*sin(2*pi*f*t+(pi));
    else
         ask=7*sin(2*pi*f*t);
         fsk=A*sin(2*pi*8*t);
         psk=A*sin(2*pi*f*t+(-3*pi/4));
    end
    subplot(3,1,1);
    plot(t,ask);
    hold on;
    grid on;
 title('Amplitude Shift Key')
    subplot(3,1,2);
    plot(t,fsk);
    hold on;
    grid on;
title('Frequency Shift Key')
    subplot(3,1,3);
    plot(t,psk);
    hold on;
    grid on;
 title('Phase Shift Key')
    i=i+1;
end
```



Conclusion: In conclusion, this experiment has provided a comprehensive understanding of digital-to-analog conversion principles and ~~the~~ the techniques using MATLAB simulations. The experiment was done properly without any errors.