EXPERIMENT REPORT

of

Digital Signal Processing

TYPICAL DIGITAL SIGNALS:

GENERATION AND ITS FREQUENCY ANALYSIS BY USING MATLAB

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1 Generation of Typical Signals

1.1 Unit Sampling Sequence

EXAMPLE: Unit sampling signal, or also can be thought as a unit sampling sequence in digital signal processing, is very unique and fundamental. After an ideal sampling, we can simply treat any sampled signals as a linear combination of a set of shifted unit sampling sequence with different amplitude scalar.

1.1.1 Signal Expression

EXAMPLE:

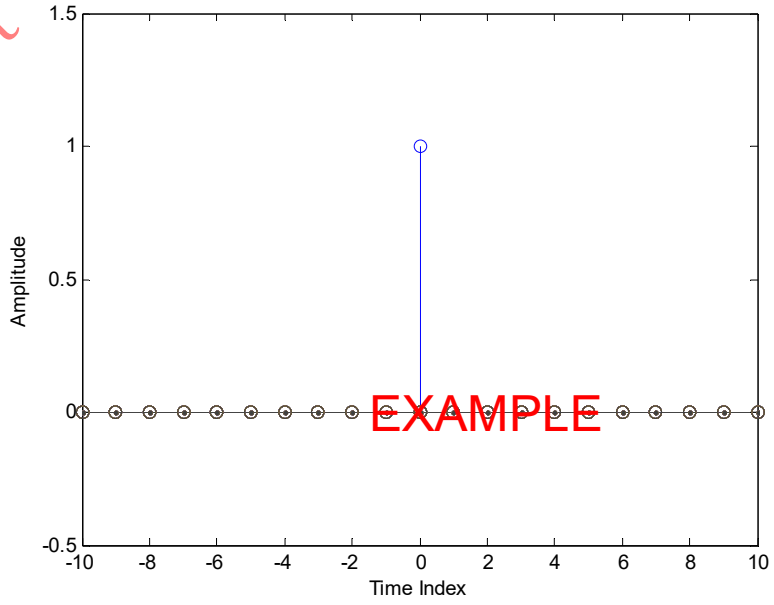
$$\delta[n]=\begin{cases}1 & n=0\\ 0 & n\neq 0\end{cases} \tag{1.1}$$

As shown in Eq(1.1), a unit sampling sequence $\delta[n]$ equals 1 only at $n=0$

1.1.2 MATLAB Codes (*with Notes*)

```
% This is an EXAMPLE
clear;          % Clear workspace
clc;            % Clear message queue
k=0;            % Shifted Time Index
N=50;           % Total number of samples
delta=zeros(N); % Generate a N-length zero sequence
……..
```

1.1.3 Simulation Results and Illustrations



1.2 Unit Step Sequence

1.2.1 Signal Expression

1.2.2 MATLAB Codes (*with Notes*)

1.2.3 Simulation Results and Illustrations

1.3 Real Exponential Sequence

1.3.1 Signal Expression

1.3.2 MATLAB Codes (*with Notes*)

1.3.3 Simulation Results and Illustrations

1.4 Complex Exponential Sequence

1.4.1 Signal Expression

1.4.2 MATLAB Codes (*with Notes*)

1.4.3 Simulation Results and Illustrations

1.5 Sinusoidal Sequence

1.5.1 Signal Expression

1.5.2 MATLAB Codes (*with Notes*)

1.5.3 Simulation Results and Illustrations

1.6 Summary and Discussion

2 Frequency Analysis

2.1 Discrete Time Fourier Transform (DTFT)

2.1.1 Concept of DTFT

2.1.2 Signal Expression in Frequency Domain

2.1.3 MATLAB Codes (*with Notes*)

2.1.4 Simulation Results and Illustration

2.2 Discrete Fourier Transform (DFT)

2.2.1 Concept of DFT

2.2.2 MATLAB Codes (*with Notes and Different Signal Length* N)

2.2.2.1 Unit Sampling Sequence

2.2.2.2 Unit Step Sequence

2.2.2.3 Real Exponential Sequence

2.2.2.4 Complex Exponential Sequence

2.2.2.5 Sinusoidal Sequence

2.2.3 Simulation Results and Illustrations (*with Different Signal Length* N)

2.3 Summary and Discussion

3 Speech Signal Analysis

3.1 MATLAB Codes (*with Notes*)

3.2 Simulation Results and Illustrations (*both Male and Female Speech Signals*)

3.3 Summary and Discussion

4 Additional Tasks

4.1 Plot the Complex Exponential Sequence in 3-D

4.1.1 MATLAB Codes (*with Notes*)

4.1.2 Simulation Results and Illustration (*with Different* ω)

4.1.3 Summary and Discussion

4.2 Realize the DFT

4.2.1 MATLAB Codes (*with Notes*)

4.2.2 Simulation Results and Illustrations

4.2.3 Summary and Discussion

4.3 Compare the performance of DFT realized above and FFT

4.3.1 MATLAB Codes (*with Notes*)

4.3.2 Simulation Results and Illustrations

4.3.3 Summary and Discussion

5 Experience and Overview