**Assignment 3**

**Team Members**

|  |  |  |  |
| --- | --- | --- | --- |
| **Num** | **Full Name in ARABIC** | SEC | BN |
| 1 | أحمد محمد أحمد لطفي | 1 | 9 |
| 2 | هبة أشرف رسلان عبدالمعبود | 2 | 33 |
| 3 | كريم أشرف | 2 | 7 |

**Table of contents:**

[1. Part One 3](#_Toc135281088)

[1.1 Gram-Schmidt Orthogonalization 3](#_Toc135281089)

[1.2 Signal Space Representation 4](#_Toc135281090)

[1.3 Signal Space Representation with adding AWGN 5](#_Toc135281091)

[1.4 Noise Effect on Signal Space 6](#_Toc135281092)

[2. Appendix A: Codes for Part One: 7](#_Toc135281093)

[A.1 Code for Gram-Schmidt Orthogonalization 10](#_Toc135281094)

[A.2 Code for Signal Space representation 10](#_Toc135281095)

[A.3 Code for plotting the bases functions 11](#_Toc135281096)

[A.4 Code for plotting the Signal space Representations 11](#_Toc135281097)

[A.5 Code for effect of noise on the Signal space Representations 12](#_Toc135281098)

**List of Figures**

[Figure 1 Φ1 VS time after using the GM\_Bases function 3](#_Toc135281077)

[Figure 2 Φ2 VS time after using the GM\_Bases function 4](#_Toc135281078)

[Figure 3 Signal Space representation of signals s1,s2 5](#_Toc135281079)

[Figure 4 Signal Space representation of signals s1,s2 with E/σ¬2 =10dB 6](#_Toc135281080)

[Figure 5 Signal Space representation of signals s1,s2 with E/σ¬2 =0dB 7](#_Toc135281081)

[Figure 6 Signal Space representation of signals s1,s2 with E/σ¬2 =-5dB 8](#_Toc135281082)

# Part One

## 1.1 Gram-Schmidt Orthogonalization

Gram-Schmidt orthogonalization is a process used to transform a set of linearly independent vectors into an orthogonal or orthonormal set.

A screenshot of a computer

Description automatically generated

Figure Φ1 VS time after using the GM\_Bases function

A screenshot of a computer

Description automatically generated

Figure Φ2 VS time after using the GM\_Bases function

## 

## 1.2 Signal Space Representation

Here we represent the signals using the base functions.

A picture containing line, diagram, plot, screenshot

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Figure Signal Space representation of signals s1,s2

## 1.3 Signal Space Representation with adding AWGN

-the expected real points will be solid and the received will be hollow

**Case 1**:

A diagram of signal points

Description automatically generated with low confidence

Figure Signal Space representation of signals s1,s2 with E/σ¬2 =10dB

**Case 2**:

A diagram of signal points

Description automatically generated with low confidence

Figure Signal Space representation of signals s1,s2 with E/σ¬2 =0dB

**Case 3**:

A diagram of signal points

Description automatically generated with low confidence

Figure Signal Space representation of signals s1,s2 with E/σ¬2 =-5dB

## 

## 1.4 Noise Effect on Signal Space

**Noise effect on signal space**:

-As the variance (σ^2) of the additive white Gaussian noise increases, the spread

of the signal points in the signal space representation also increases. The noise

introduces uncertainty and randomness in the received signals, causing the signal

points to scatter and deviate from their original positions. Consequently, the

accuracy of the signal space representation decreases as the noise effect increases.

# Appendix A: Codes for Part One:

## A.1 Code for Gram-Schmidt Orthogonalization

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## A.2 Code for Signal Space representation

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Description automatically generated

## A.3 Code for plotting the bases functions

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Description automatically generated

## A.4 Code for plotting the Signal space Representations

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## A.5 Code for effect of noise on the Signal space Representations

