Digital Signal Processing Course Laboratory Experiments2 Report (October 2023)

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Abstract—This lab report introduces and investigates the basic concepts, representations and properties of discrete time systems. Using MATLAB to implement several discrete time systems and research their properties.

Index Terms—discrete-time systems, difference equations, MATLAB

I. Introduction

THIS report is about Lab 2, focusing on the topic of discrete-time systems. The objective of the experiment is to learn the concepts and properties of discrete-time systems, understand the principles of discrete-time signal processing, and deepen the understanding of discrete-time systems through practical operation and analysis using MATLAB. We started by introducing the concept of discrete-time systems and discussed their importance and practical applications. We also analyzed the properties of discrete-time systems. In the background exercise section of the experiment, we designed integral and derivative discrete-time systems by selecting appropriate difference equations or block diagrams. We studied a difference equation case in the stock market. Next, we write MATLAB functions to implement integral and derivative discrete-time systems and study their properties. In the following stage, we design two types of discrete-time filters, test their impulse responses, and filter an audio signal. We then attempt to create the inverse system of one of the filters and validate it. Subsequently, we investigate the properties of the systems and perform comparative tests. Finally, we apply the filters to stock market data to analyze the properties.

II. Experimental Contents

A. Breif Introduction of Discrete-Time Systems

B. Background Exercises

Figures compiled of more than one sub-figure presented side-by-side, or stacked. If a multipart figure is made up of multiple figure types

(one part is lineart, and another is grayscale or color) the figure should meet the stricter guidelines.

C. Example Discrete-Time Systems

Most charts, graphs, and tables are one column wide (3.5 inches/88 millimeters/21 picas) or page wide (7.16 inches/181 millimeters/43 picas). The maximum depth a graphic can be is 8.5 inches (216 millimeters/54 picas).

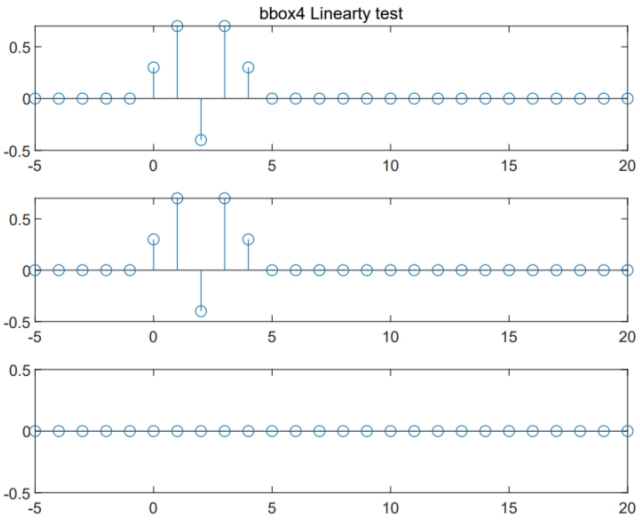

Fig. 1. bbox4 linearity test by inputs signal $x[n] = \delta[n]$ and $x[n] = u[n]$

When choosing the depth of a graphic, please allow space for a caption. Figures can be sized between column and page widths if the author chooses, however it is recommended that figures are not sized less than column width unless when necessary.

D. Difference Equations

E. Audio Filtering

F. Audio Filtering

G. Systems

H. Stock Market Example

III. Conclusion

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.