ECE 202 – LAB 4
MATLAB CONVOLUTION

BEFORE YOU BEGIN

PREREQUISITE LABS
- ECE 201 Labs
- ECE 202 Advanced MATLAB

EXPECTED KNOWLEDGE
- Understanding of Discrete convolution and LTI systems.

EQUIPMENT
- Workstation with MATLAB 6.

OBJECTIVES

After completing this lab, you should be more familiar with MATLAB. Specifically, you should be able use MATLAB to perform Convolutions on discrete data sets.

INTRODUCTION

MATLAB has many tools that assist in the development of signals and systems. These tools include functions that will perform mathematical operations of a signal, such as convolution.

PRELAB

Read sections 2.1, 2.7 basic, 2.8-2.9 in the workbook. Throughout this lab, you will be asked to create many plots and images. By now you should be familiar with how to title and label plots in MATLAB. You must label and title all plots and images turned in with your lab worksheet, even if you are not specifically told to do so.

Answer question 1.

MATLAB

The Conv function

The MATLAB function `conv` computes the convolution sum for Eq. (1). `conv` performs this sum on two vectors `(h,x)`.

\[
\text{conv}(h,x)
\]

where
**h** is a vector

**x** is a vector

For example, to convolve vectors **h** and **x**, to a new vector **y**, the command would be:

\[ y = \text{conv}(h, x) \]

This convoluted vector **y**, can now be plotted using the **stem** command.

The **conv** function can also be used to multiply two vectors if the vectors are the coefficients of polynomials. The same formatting applies. The length of the convoluted vector is the length of vector **h** + the length of vector **x** - 1. \( \Rightarrow \text{length}(y) = \text{length}(h) + \text{length}(x) - 1 \).

The **conv** function does not keep an index of the x-axis for the incident signal, therefore, you will manually need to do this. Figure 1 is an example of a non-indexed convolution plot. Figure 2 is an example of an indexed convolution plot. Notice the difference as to where the convoluted signal starts. The non-indexed convolution is automatically shifted one space.

Refer to “Computer Explorations in Signals and Systems using MATLAB” for more detail on creating an index vector.

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**Figure 1: Non-indexed convolution**

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Figure 2: Indexed convolution.

**Discrete-Time Convolution**

Perform problems (a)-(c) in section 2.7 Discrete-Time Convolution in the workbook “Computer Explorations in Signals and Systems using MATLAB” found on page 36-37 and answer questions 2-7.