Computer Lab Assignment - 03 - Spring 2020

Signals & Systems,
Anish Turlapaty PhD,
Indian Institute of Information Technology Sri City,
Sri City, Andhra Pradesh

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1 Linear Convolution

Write a matlab code for linear convolution of two signals. Then

1. Generate the causal signals

$$x_1[n] = \{-\underset{\uparrow}{2},\ 2,\ 3,\ 1,\ 12\}$$
$$x_2[n] = \{\underset{\uparrow}{1}, -1, 4, -2\}$$
$$h[n] = \{\underset{\uparrow}{3},\ -2,\ -5,\ 1,\ -4\}$$

Now, determine the output of the given systems

$$y_1[n] = (x_1[n] + x_2[n]) * h[n]$$
$$y_2[n] = x_1[n] * h[n] + x_2[n] * h[n]$$

   (a) Perform the calculations using your matlab code and verify the results using the inbuilt function *conv* and on-paper calculations.
   (b) Verify if the outputs $y_1[n]$ and $y_2[n]$ are identical or not.
   (c) Using the *stem* function, plot the signals $x_1[n]$, $x_2[n]$, $h[n]$, $y_1[n]$ and $y_2[n]$.

2. Next, generate the translated signals

$$x[n] = \{3,\ 3,\ \underset{\uparrow}{1},\ 2,\ 3,\}$$
$$h[n] = \{1,\ 2,\ \underset{\uparrow}{3},\ 2,\ 1\}$$

Now, determine the output of the given system

$$y[n] = x[n] * h[n]$$

(a) Perform the calculations using your matlab code and verify the results using the inbuilt function *conv* and on-paper calculations.

(b) Using the *stem* function, plot the signals $x[n]$, $h[n]$, and $y[n]$.

3. Next generate the signals

$$
\begin{aligned}
x[n] &= \{\underset{\uparrow}{2},\ -1,\ 4,\ -7,\ 5\} \\
h[n] &= \{\underset{\uparrow}{2},\ 4,\ 2,\ 4,\ 1\}
\end{aligned}
$$

Now, compute the ouput of the given systems

$$
\begin{aligned}
y_1[n] &= x[n] * h[-n] \\
y_2[n] &= x[3-n] * h[n]
\end{aligned}
$$

(a) Perform the calculations using your matlab code and verify the results using the inbuilt function *conv* and on-paper calculations.

(b) Using the *stem* function, plot the signals $x[n]$, $h[n]$, $y_1[n]$ and $y_2[n]$.

2 Instructions and grading scheme

Merge all the sections into a single pdf file and upload.

- Section 1: Matlab code and results (Max Grade: 3 points)

- Section 2: Matlab code and results (Max Grade: 4 points)

- Section 3: Matlab code and results (Max Grade: 3 points)