Computer Assignment - 02 - Spring 2019

Signals & Systems
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1 Linear Convolution

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

1. Generate the causal signals

$$
\begin{aligned}
x_1[n] &= \{\underset{\uparrow}{3},\ 1,\ 4,\ 16,\ 2\} \\
x_2[n] &= \{\underset{\uparrow}{3}, -1, 3, -1\} \\
h[n] &= \{\underset{\uparrow}{2},\ -1,\ -4,\ 1,\ -3\}
\end{aligned}
$$

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 signals

$$
\begin{aligned}
x[n] &= \{-3,\ -2, 0, \underset{\uparrow}{1},\ 2,\ 3,\} \\
h[n] &= \{\underset{\uparrow}{3},\ 1,\ 1,\ 3,\ 1,\ 1\}
\end{aligned}
$$

Now, determine the output of the given system

$$
y[n] = x[n-3] * h[n]
$$

(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 causal signals

$$x[n] = \{\underset{\uparrow}{1},\ 2,\ -3,\ 8,\ -9\}$$

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

Now, compute the ouput of the given systems

$$y_1[n] = x[n] * h[1-n]$$
$$y_2[n] = x[1-n] * h[n]$$

(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 $x[n]$, $h[n]$, $y_1[n]$ and $y_2[n]$.

(c) Verify if the outputs $y_1[n]$ and $y_2[n]$ are identical or not.

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)