

Experiment-3: Convolution

Signals and Systems Lab(EC2P002)
School of Electrical Sciences, IIT Bhubaneswar
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Agenda of the Experiment

In this lab session, we will do the following:

- Implement discrete convolution
- Learn to use convolution function in MATLAB

In class, we learn that the convolution between two sequences $x[n]$ and $h[n]$ is

$$x[n] * h[n] = y[n] = \sum_{k=-\infty}^{\infty} x[k]h[n-k]$$

1. Write a function which takes four inputs: a vector x , a vector h , and two indices N_1 and N_2 which indicate the position of the zero (time zero) in the sequence. The function should output a vector y which is the result of convolution of sequences x and h and an index N_3 which indicates the position of zero in the sequence. You can assume that the input sequences have zero values outside the specified input value.
2. Perform the convolution of following sequences
 - (a) $x[n] = [1 \ 2 \ 3]$, $N_1 = 1$ and $h[n] = [1 \ -1]$, $N_2 = 1$
 - (b) $x[n] = [1 \ 2 \ 3]$, $N_1 = 2$ and $h[n] = [1 \ -1]$, $N_2 = 1$
 - (c) $x[n] = [1 \ 2 \ 3]$, $N_1 = 3$ and $h[n] = [1 \ -1]$, $N_2 = 2$
 - (c) $x[n] = [0.5 \ 1]$, $N_1 = 2$ and $h[n] = [2 \ 0 \ 2]$, $N_2 = 3$.

Plot the input, impulse response and the convolution output for each of the above questions. Verify your results by performing convolution manually.

3. Type *help conv* and learn about the built in function of convolution sequence.
4. Use *conv* function to perform the convolution of the signals in Question 2.
5. Observe from part 2(b) that delaying the input signals only results in a delay of the output signal. Why?
6. Type *help convmtx* and learn how to perform convolution using matrix multiplication.
7. Repeat Question 2 by using *convmtx* and matrix multiplication.