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| **Experiment 1** | |
| **AIM:** | **The aim of this experiment is to study mathematical operation such as: Linear Convolution, Circular Convolution, and Linear Convolution using Circular Convolution.** |
| **OBJECTIVES:** | **1. To Develop a function to find Linear Convolution and Circular Convolution**  **2. To Calculate Linear convolution, Circular convolution, Linear Convolution using Circular Convolution and verify the results using mathematical formulation.**  **3. To Conclude on aliasing effect in Circular convolution** |
| **PROBLEM DEFINITION:** | **1. Find Linear Convolution and Circular Convolution of L point sequence x[n] and M point sequence h[n].**  **2. Find Linear Convolution of L point sequence x[n] and M point sequence h[n] using Circular convolution.**  **3. Give your conclusion about No of values in Linearly Convolved signal, Aliasing effect in Circular Convolution** |
| **INPUT SEQUENCE:** | 1. Length of first Signal L and signal values.  2. Length of second Signal M and signal values. |
| **PROGRAM:** | **Case 1: To find y[n] = x[n] \* h[n]**  Input:  x[n] = {11, 14, 15, 20, 28} Length L = 5  h[n] = {1, 3, 5, 7} Length M = 4  Output:  y[n] = {11, 47, 112, 212, 261, 289, 280, 196} Length N = 8    **Analysis:**  • Length of Linear Convolution output signal is  N = 5 + 4 - 1 = 8  Hence, Length of Linear Convolution output signal is N = L + M - 1  **Case 2: To find y[n] = x[n] ⊛ h[n]**  Input:  x[n] = { 11, 14, 15, 20, 28 } Length L = 5  h[n] = { 1, 3, 5, 7 } Length M = 4  Output:  y[n] = { 300, 327, 308, 212, 261 } Length N = 5    **Analysis:**  The last two values are same 212, 261 and the other values are obtained  using the linear convolution signal values i.e.,  Linear > y[n] = {11, 47, 112, 212, 261, 289, 280, 196}  Circular > y[n] = { 300(11+289), 327(47+280), 308(112+196), 212, 261 }  Hence, Circular Convolution gives aliased output; the first few values of  Circular Convolution output signal are aliased with the values beyond N.  **Case 3: To find y[n] = x[n] \* h[n] using Circular Convolution**  Input:  x[n] = { 11, 14, 15, 20, 28, 0, 0, 0 } Length L = 8  h[n] = { 1, 3, 5, 7, 0, 0, 0, 0 } Length M = 8  Output:  y[n] = { 11, 47, 112, 212, 261, 289, 280, 196 } Length N = 8    **Analysis:**  We must select a value N >= L + M - 1 and use L = N & M = N with L  values in signal x being its initial values and N - L being 0's. Similarly,  for the signal y. Using this, we get the linear convolution of signals using the circular convolution technique. |
| **CONCLUSION:**  In this experiment, we learned that: 1. Length of Linear Convolution output signal is N = L + M -1  ● Where L is the length of first input signal  ● M is the length of second input signal  ● N is the length of the linear convolution output signal.  2. In Linear convolution if both the input signals are causal, then the  resultant output signal is also causal.  3. To find Circular Convolution, select N = MAX(L,M)  ● Where L is the length of first input signal  ● M is the length of second input signal  4. To find Linear Convolution using Circular Convolution, select  N >= L + M -1  ● Where L is the length of first input signal and  ● M is the length of the second input signal.  5. Circular Convolution gives aliased output. | |