جامعة الإسكندرية
ALEXANDRIA UNIVERSITY

EEC-371 Digital Signal Processing

Lab2 Report (Sliding DFT)

ECE LEVEL 3

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The Sliding DFT:

In this lab, it is required to compute the sliding DFT of the given the sequence X[n] = [1 -4 3 8 2 7 3 5 1 8] using DFT of size (N=5).

SDFT Code Algorithm:

- Get the DFT of the first 5 elements.
- Create X (Zero matrix) of size 6x5, rows (# of windows) = len (x) – N+1=10-5+1= 6 and columns = N =5 .
- The first row equals the DFT of the first 5 elements (first window).
- Through FOR loop we get the DFTs of the successive windowed sequences, each of length N using the SDFT algorithm:

$$\boxed{X_k(n) = [X_k(n-1) - x(n-N) + x(n)]\, e^{j2\pi k/N}}$$

MATLAB code:

sliding_DFT.m

```
x = [1, -4, 3, 8, 2, 7, 3, 5, 1, 8];
N = 5;
W1 = fft(x, N);
X = zeros(length(x)- N + 1, N);
X(1,:) = W1;
k = [0 : N-1];
for n = 2 : 1 : length(x)- N + 1
    X(n,:) = (X(n-1,k+1) - x(n-1) + x(n-1+N)).*exp(1i*2*pi*k/N);
end
X
```

Output:

Command Window

```
X =

  10.0000 + 0.0000i  -8.5172 + 8.6453i   6.0172 - 1.2286i   6.0172 + 1.2286i  -8.5172 - 8.6453i
  16.0000 + 0.0000i  -9.0000 + 0.2775i  -9.0000 + 8.0575i  -9.0000 - 8.0575i  -9.0000 - 0.2775i
  23.0000 + 0.0000i  -0.8820 - 1.8164i  -3.1180 - 7.6942i  -3.1180 + 7.6942i  -0.8820 + 1.8164i
  25.0000 + 0.0000i   2.0729 + 0.5020i   5.4271 + 5.5676i   5.4271 - 5.5676i   2.0729 - 0.5020i
  18.0000 + 0.0000i  -2.0000 - 4.5308i  -2.0000 - 5.4288i  -2.0000 + 5.4288i  -2.0000 + 4.5308i
  24.0000 + 0.0000i   5.5451 + 2.4041i  -0.0451 + 6.7432i  -0.0451 - 6.7432i   5.5451 - 2.4041i
```

X values through each iteration:

Command Window

```
X =

  10.0000 + 0.0000i  -8.5172 + 8.6453i   6.0172 - 1.2286i   6.0172 + 1.2286i  -8.5172 - 8.6453i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i


X =

  10.0000 + 0.0000i  -8.5172 + 8.6453i   6.0172 - 1.2286i   6.0172 + 1.2286i  -8.5172 - 8.6453i
  16.0000 + 0.0000i  -9.0000 + 0.2775i  -9.0000 + 8.0575i  -9.0000 - 8.0575i  -9.0000 - 0.2775i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i


X =

  10.0000 + 0.0000i  -8.5172 + 8.6453i   6.0172 - 1.2286i   6.0172 + 1.2286i  -8.5172 - 8.6453i
  16.0000 + 0.0000i  -9.0000 + 0.2775i  -9.0000 + 8.0575i  -9.0000 - 8.0575i  -9.0000 - 0.2775i
  23.0000 + 0.0000i  -0.8820 - 1.8164i  -3.1180 - 7.6942i  -3.1180 + 7.6942i  -0.8820 + 1.8164i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i

X =

  10.0000 + 0.0000i  -8.5172 + 8.6453i   6.0172 - 1.2286i   6.0172 + 1.2286i  -8.5172 - 8.6453i
  16.0000 + 0.0000i  -9.0000 + 0.2775i  -9.0000 + 8.0575i  -9.0000 - 8.0575i  -9.0000 - 0.2775i
  23.0000 + 0.0000i  -0.8820 - 1.8164i  -3.1180 - 7.6942i  -3.1180 + 7.6942i  -0.8820 + 1.8164i
  25.0000 + 0.0000i   2.0729 + 0.5020i   5.4271 + 5.5676i   5.4271 - 5.5676i   2.0729 - 0.5020i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i


X =

  10.0000 + 0.0000i  -8.5172 + 8.6453i   6.0172 - 1.2286i   6.0172 + 1.2286i  -8.5172 - 8.6453i
  16.0000 + 0.0000i  -9.0000 + 0.2775i  -9.0000 + 8.0575i  -9.0000 - 8.0575i  -9.0000 - 0.2775i
  23.0000 + 0.0000i  -0.8820 - 1.8164i  -3.1180 - 7.6942i  -3.1180 + 7.6942i  -0.8820 + 1.8164i
  25.0000 + 0.0000i   2.0729 + 0.5020i   5.4271 + 5.5676i   5.4271 - 5.5676i   2.0729 - 0.5020i
  18.0000 + 0.0000i  -2.0000 - 4.5308i  -2.0000 - 5.4288i  -2.0000 + 5.4288i  -2.0000 + 4.5308i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i


X =

  10.0000 + 0.0000i  -8.5172 + 8.6453i   6.0172 - 1.2286i   6.0172 + 1.2286i  -8.5172 - 8.6453i
  16.0000 + 0.0000i  -9.0000 + 0.2775i  -9.0000 + 8.0575i  -9.0000 - 8.0575i  -9.0000 - 0.2775i
  23.0000 + 0.0000i  -0.8820 - 1.8164i  -3.1180 - 7.6942i  -3.1180 + 7.6942i  -0.8820 + 1.8164i
  25.0000 + 0.0000i   2.0729 + 0.5020i   5.4271 + 5.5676i   5.4271 - 5.5676i   2.0729 - 0.5020i
  18.0000 + 0.0000i  -2.0000 - 4.5308i  -2.0000 - 5.4288i  -2.0000 + 5.4288i  -2.0000 + 4.5308i
  24.0000 + 0.0000i   5.5451 + 2.4041i  -0.0451 + 6.7432i  -0.0451 - 6.7432i   5.5451 - 2.4041i
```