Digital Signal Processing: 실습 2
제2장 이산시간 신호 및 시스템

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March 26, 2016

Abstract

MATLAB을 사용한 Digital Signal Processing에 대한 실습과제에 대한 Documents를 구성한다.

1 Example 2-1:

1.1 2-1-1

```
n=[-5:5];
x = 2 * impseq(-2,-5,5) - impseq(4,-5,5);
subplot(2,2,1);
stem(n,x); title('Sequence in Problem 2.1a');
xlabel('n'); ylabel('x(n)');
```

1.2 2-1-2

```
n=[0:20];
x1 = n.*(stepseq(0,0,20) - stepseq(10,0,20));
x2 = 10*exp(-0.3*(n-10)).*(stepseq(10,0,20)-stepseq(20,0,20));
x = x1+x2;
subplot(2,2,2);
stem(n,x); title('Sequence in Problem 2.1b');
xlabel('n'); ylabel('x(n)');
```

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1.3 2-1-3

```
n=[0:50];
x = cos(0.04*pi*n) + 0.2*randn(size(n));
subplot(2,2,3);
stem(n,x); title('Sequence in Problem 2.1c');
xlabel('n'); ylabel('x(n)');
```

1.4 2-1-4

```
n=[-10:9];
x = [5,4,3,2,1];
xtilde = x' * ones(1, 4); xtilde = (xtilde(:))';
subplot(2,2,4);
stem(n,xtilde); title('Sequence in Problem 2.1d');
xlabel('n'); ylabel('xtilde(n)');
```

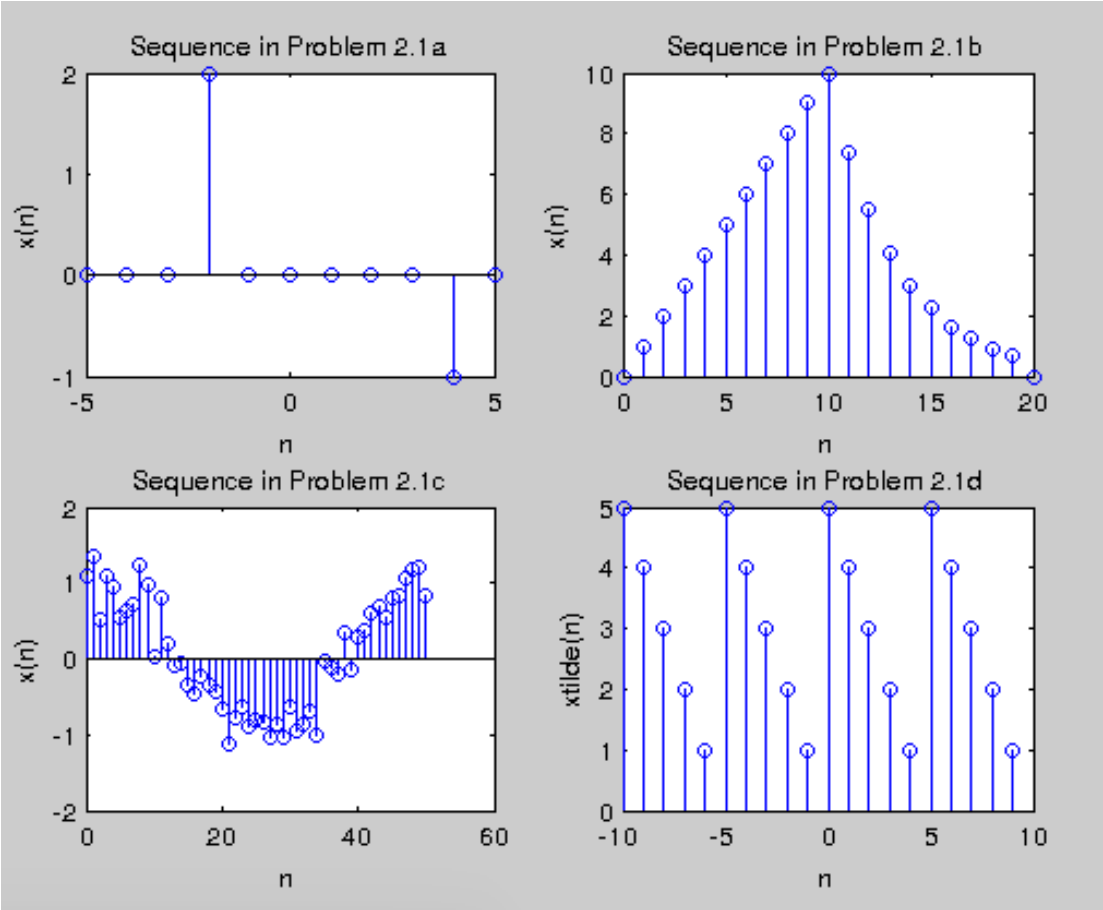

Figure 1 Example 2.1 Result

2 Example 2-2:

2.1 2-2-1

```
[x11,n11]=sigshift(x,n,5); [x12,n12]=sigshift(x, n, -4);
[x1, n1]= sigadd(2*x11, n11, -3*x12, n12);
subplot(2,1,1);
stem(n1,x1); title('Sequence in Example 2.2a');
xlabel('n'); ylabel('x1(n)');
```

2.2 2-2-2

```
[x21,n21]=sigfold(x,n); [x21,n21]=sigshift(x21, n21, 3);
[x22,n22]= sigshift(x,n,2); [x22,n22]=sigmult(x,n,x22,n22);
[x2,n2]= sigadd(x21,n21, x22,n22);
subplot(2,1,2);
stem(n2,x2); title('Sequence in Example 2.2b');
xlabel('n'); ylabel('x2(n)');
```

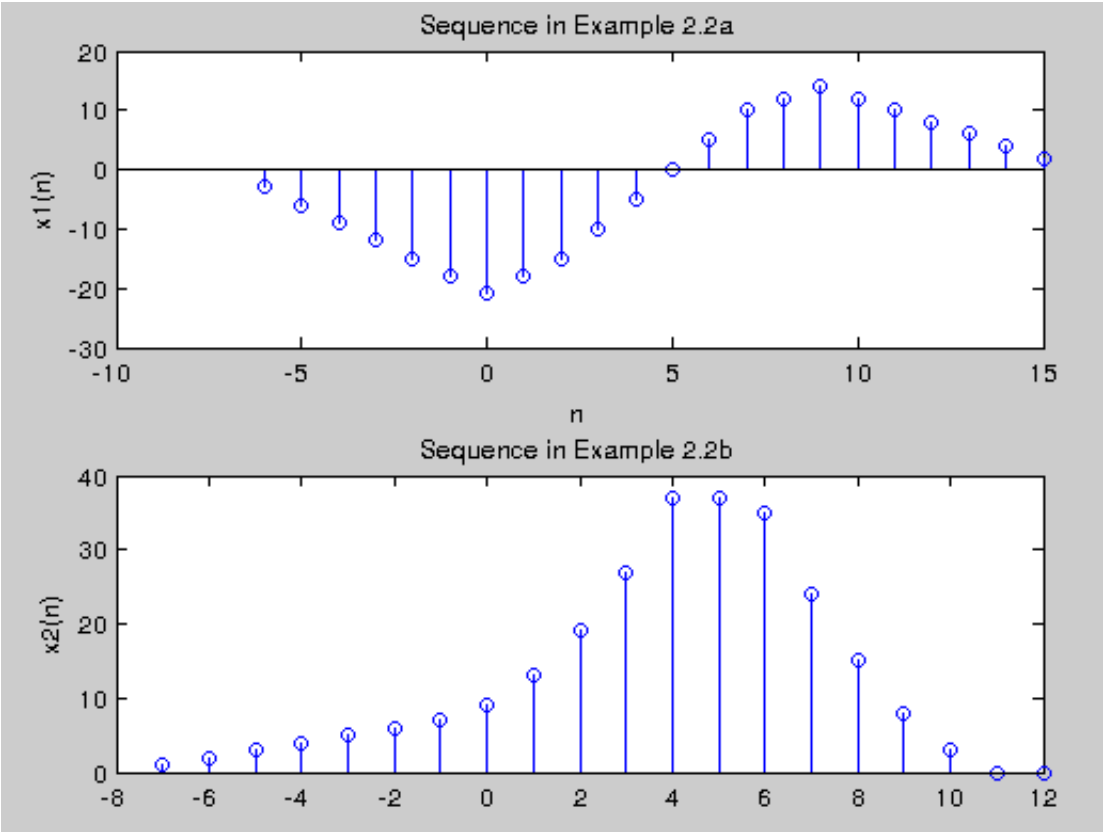

Figure 2 Example 2.2 Result

3 Example 2-3:

```
n=[-10:1:10]; alpha = -0.1+0.3j;
x = exp(alpha*n);
subplot(2,2,1); stem(n, real(x)); title('Real part'); xlabel('n');
subplot(2,2,2); stem(n, imag(x)); title('Imaginary part'); xlabel('n');
subplot(2,2,3); stem(n, abs(x)); title('Magnitude part'); xlabel('n');
subplot(2,2,4); stem(n, (180/pi)*angle(x)); title('Phase part'); xlabel('n');
```

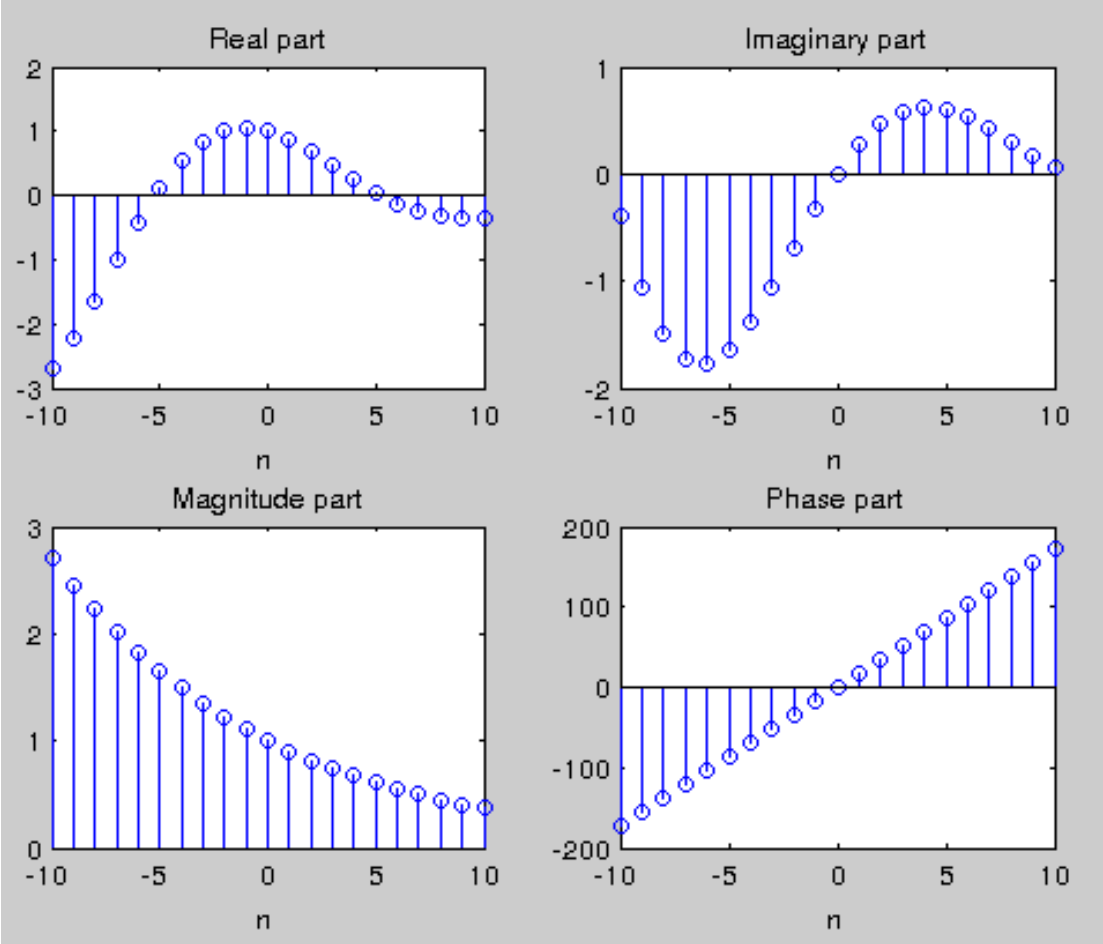

Figure 3 Example 2.3 Result

4 Example 2-4:

```
n=[0:10]; x = stepseq(0,0,10)-stepseq(10,0,10);
[xe,xo,m]=evenodd(x,n);

subplot(2,2,1); stem(n,x); title('Rectangura pulse');
```

```
xlabel('n'); ylabel('x(n)'); axis([-10,10,0,1.2]);

subplot(2,2,2); stem(m,xe); title('Even Part');
xlabel('n'); ylabel('xe(n)'); axis([-10,10,0,1.2]);

subplot(2,2,4); stem(m,xo); title('Odd Part');
xlabel('n'); ylabel('xo(n)'); axis([-10,10,-0.6,0.6]);
```

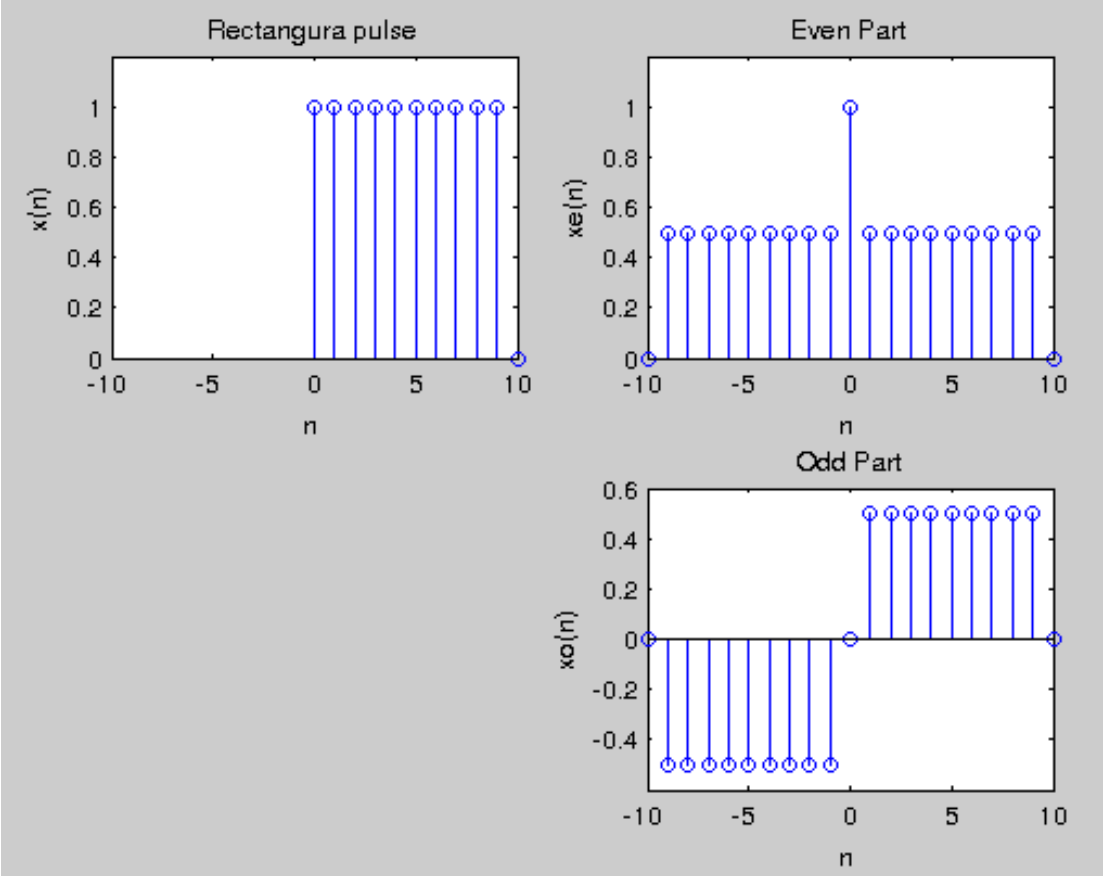

Figure 4 Example 2.4 Result

5 Example 2-7:

$$h(n) = (0.9)^n u(n) \tag{1}$$

에 대한 출력 y(n) 을 구하라.
풀이)

$$y(n) = \sum_{k=0}^{9} (1)(0.9)^{(n-k)} u(n-k) = (0.9)^n \sum_{k=0}^{9} (0.9)^{-k} u(n-k) \tag{2}$$

5.1 경우 1.

n < 0 인 경우,

$$y(n) = 0 \tag{3}$$

x(n)과 h(n)의 0이 아닌 값들은 겹치지 않는다.

5.2 경우 2.

0 <= n < 9 인 경우,

$$y(n) = (0.9)^n \sum_{k=0}^{n} (0.9)^{-k} = 10[1 - (0.9)^{n+1}], 0 \leq n < 9 \tag{4}$$

임펄스 응답 h(n)은 입력 x(n) 에 일부 겹치는 구간이 발생한다.

5.3 경우 3.

n >= 9 인 경우,

$$y(n) = (0.9)^n \sum_{k=0}^{n} (0.9)^{-k} = 10(0.9)^{n-9}[1 - (0.9)^{10}], n \geq 9 \tag{5}$$

임펄스 응답 h(n)은 입력 x(n) 에 완전히 겹친다.

6 Example 2-8:

```
x = [3, 11, 7, 0, -1, 4, 2]; nx =[-3:3];
h = [2, 3, 0, -5, 2, 1]; nh = [-1:4];
[y,ny] = conv_m(x,nx,h,nh);
y
ny
```

```
>> EX28

y =

     6    31    47     6   -51    -5    41    18   -22    -3     8     2

ny =

    -4    -3    -2    -1     0     1     2     3     4     5     6     7
```

Figure 5 Example 2.8 Result