

Homework3_3

Programmers

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Clear workspace

```
close all;  
clear;  
clc;
```

Homework1

Here we want to check if the presented equation is valid or not

```
fs = 100;  
t = 0:1 / fs:1;  
f = 10;  
A = [2 4 0.5];
```

Here we check for different "A"s

```
for i = 1:1:3  
    x = A(i) .* cos(2 * pi * f * t);  
    x_mean = (2 / pi) .* A(i);  
    ms_x = 0.5 * A(i) ^ 2;  
    disp(x_mean);  
    disp(mean(abs(x)));  
    disp(ms_x);  
    disp(mean(x .^ 2));  
end
```

```
1.2732  
1.3014  
2  
2.0198  
2.5465  
2.6028  
8  
8.0792  
0.3183  
0.3254  
0.1250  
0.1262
```

Homework2

Here we want to replot figure 6-11 again

First we need to declare essential variables

```
w0 = pi * 0.15;
```

```

n = [0:199; 200:399; 400:599];
A = [2 4 0.5];
x = cos(w0 * n) .* A';
x = x';
x = x(1:end);
n = n';
n = n(1:end);
lambda = 0.9;
c0 = 0.5;
rho = 0.2;
b = 1 - lambda;
a = [1 -lambda];
cn = filter(b, a, abs(x));
gn = ones(1, length(cn));
gn(cn >= c0) = (cn(cn >= c0) / c0) .^ (rho - 1);
yn = gn .* x;

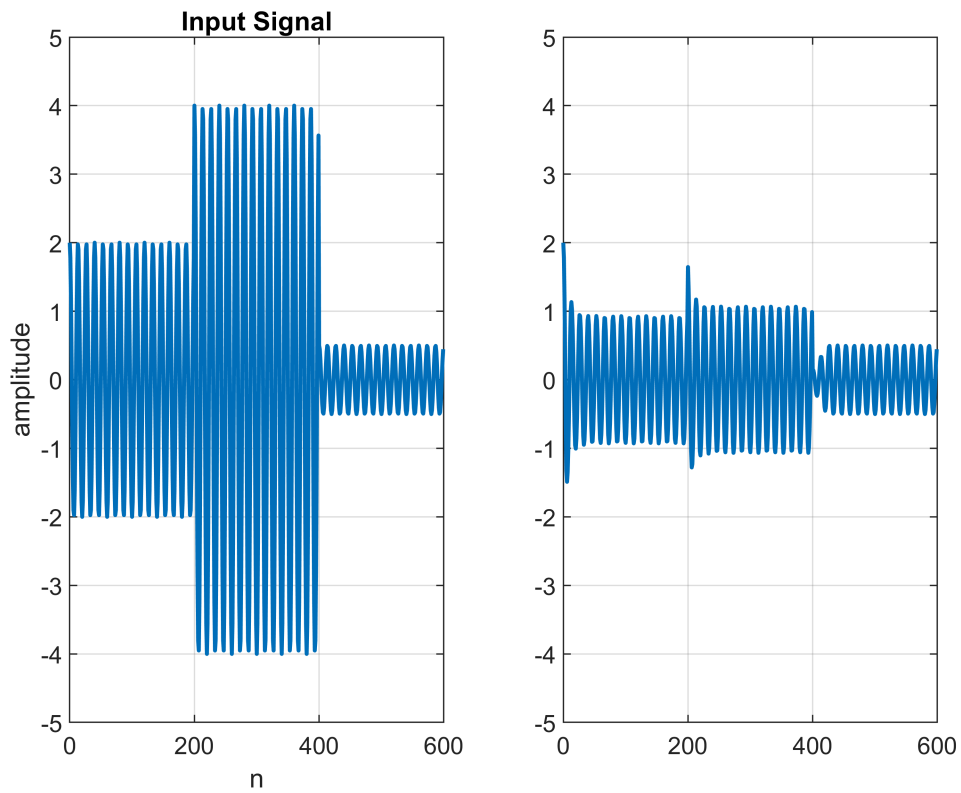
```

Fig 3.6

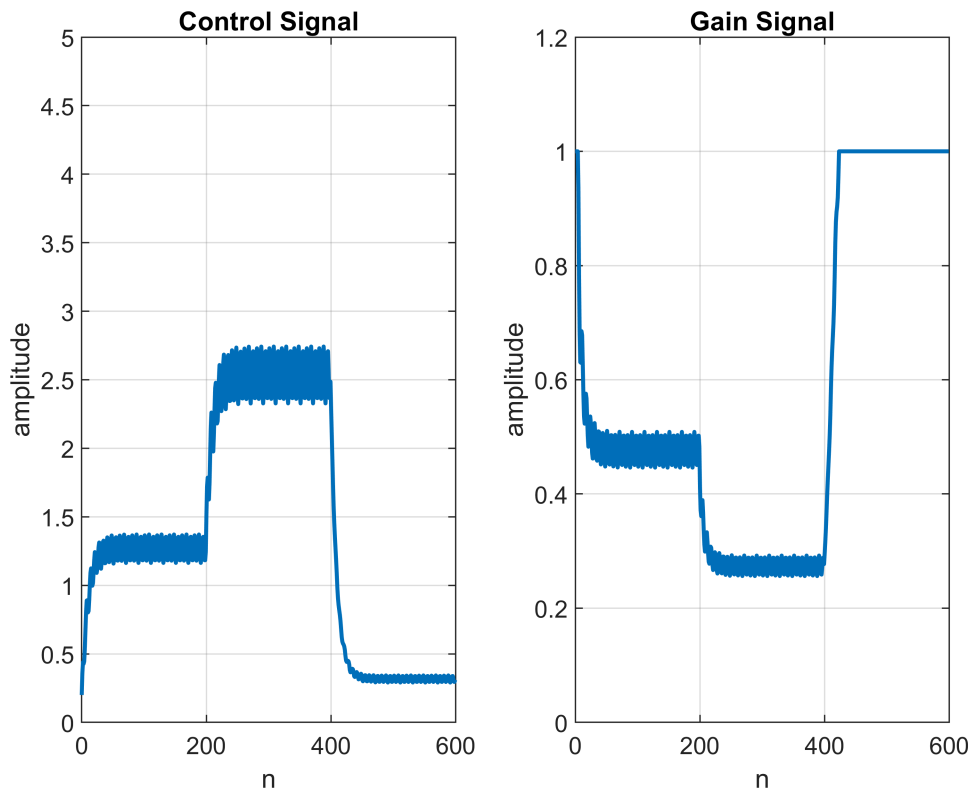
```

figure('Name', 'Input Signal vs Compressed Signal');
subplot(1, 2, 1)
plot(n, x, 'LineWidth', 1.5);
xlim([0 600]);
ylim([-5 5]);
grid on;
title('Input Signal');
xlabel('n');
ylabel('amplitude');
subplot(1, 2, 2)
plot(n, yn, 'LineWidth', 1.5);
xlim([0 600]);
ylim([-5 5]);
grid on;

```



```
figure('Name', 'Contol Signal vs Gain Signal');
subplot(1, 2, 1);
plot(n, cn, 'LineWidth', 1.5);
title('Control Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([0 5]);
grid on;
subplot(1, 2, 2);
plot(n, gn, 'LineWidth', 1.5);
title('Gain Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([0 1.2]);
grid on;
```



```

L = 7;
cn_smoothed = movmean(cn, [L - 1 0]);
gn_smoothed = ones(1, length(cn_smoothed));
gn_smoothed(cn_smoothed >= c0) = (cn_smoothed(cn_smoothed >= c0) / c0) .^ (rho - 1);
yn_smoothed = gn_smoothed .* x;

figure('Name', 'Smoothed Control Signal vs Smoothed Gain Signal');
subplot(1, 2, 1);
plot(n, cn_smoothed, 'LineWidth', 1.5);
title('Smoothed Control Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([0 5]);
grid on;
subplot(1, 2, 2);
plot(n, gn_smoothed, 'LineWidth', 1.5);
title('Smoothed Gain Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([0 1.2]);
grid on;

```

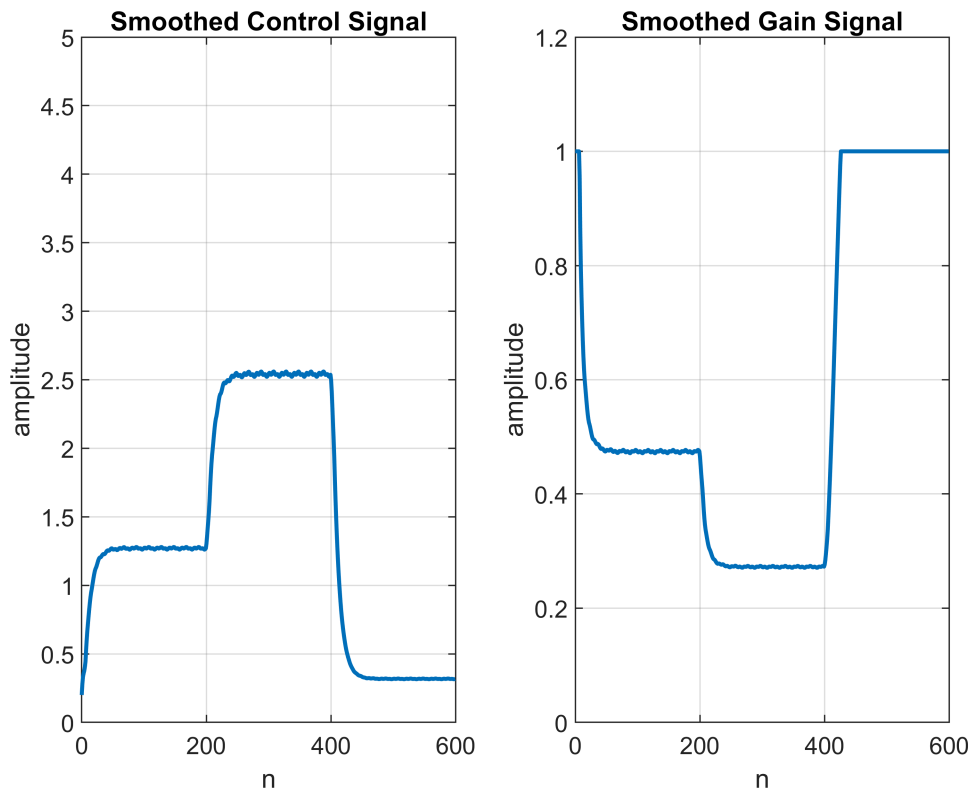
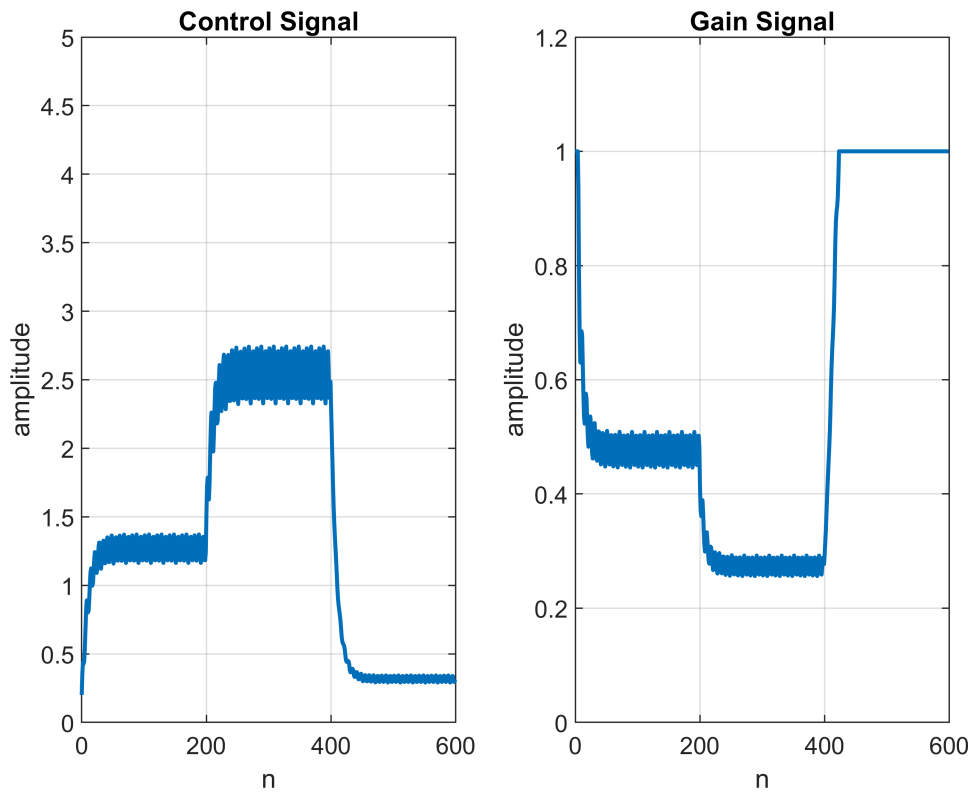


Fig 3.7

```
figure('Name', 'Contol Signal vs Gain Signal (3.7)');
subplot(1, 2, 1);
plot(n, cn, 'LineWidth', 1.5);
title('Control Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([0 5]);
grid on;
subplot(1, 2, 2);
plot(n, gn, 'LineWidth', 1.5);
title('Gain Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([0 1.2]);
grid on;
```



```
L = 7;
cn_smoothed = movmean(cn, [L - 1 0]);
gn_smoothed = ones(1, length(cn_smoothed));
gn_smoothed(cn_smoothed >= c0) = (cn_smoothed(cn_smoothed >= c0) / c0) .^ (rho - 1);
yn_smoothed = gn_smoothed .* x;
```

Fig 3.8

```
figure('Name', 'Smoothed Output Signal vs Smoothed Gain Signal (3.8)');
subplot(1, 2, 1);
plot(n, yn_smoothed, 'LineWidth', 1.5);
title('Smoothed Output Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([-5 5]);
grid on;
subplot(1, 2, 2);
plot(n, gn_smoothed, 'LineWidth', 1.5);
title('Smoothed Gain Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([-2 2]);
grid on;
```

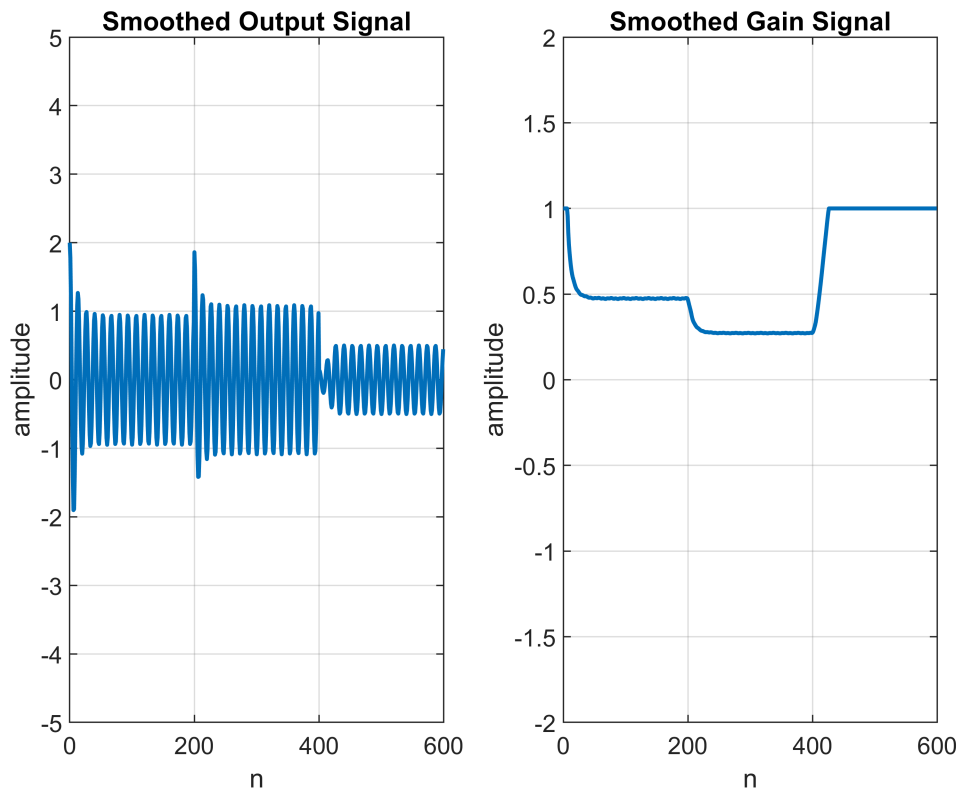


Fig.3.9

```

lambda = 0.1;
c0 = 1.5;
rho = 0.1;
b = 1 - lambda;
a = [1, -lambda];
cn = filter(b, a, abs(x));

L = 7;
cn_smoothed = movmean(cn, L);
gn_smoothed = ones(1, length(cn_smoothed));
gn_smoothed(cn_smoothed >= c0) = (cn_smoothed(cn_smoothed >= c0) / c0) .^ (rho - 1);
yn_smoothed = gn_smoothed .* x;

figure('Name', 'Smoothed Output Signal vs Smoothed Gain Signal (3.9)');
subplot(1, 2, 1);
plot(n, yn_smoothed, 'LineWidth', 1.5);
title('Smoothed Output Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([-5 5]);
grid on;
subplot(1, 2, 2);
plot(n, gn_smoothed, 'LineWidth', 1.5);
title('Smoothed Gain Signal');
xlabel('n');

```

```

ylabel('amplitude');
xlim([0 600]);
ylim([-2 2]);
grid on;

```

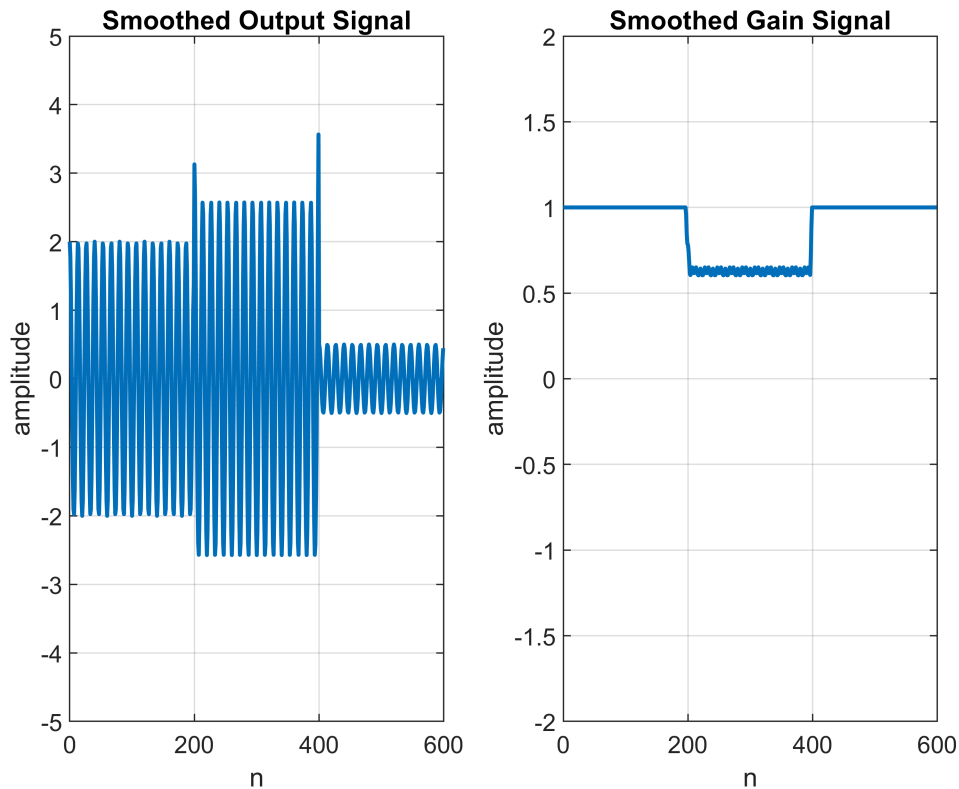


Fig 3.10

```

lambda = 0.9;
c0 = 0.5;
rho = 2;
b = 1 - lambda;
a = [1, -lambda];
cn = filter(b, a, abs(x));

L = 7;
cn_smoothed = movmean(cn, L);
gn_smoothed = ones(1, length(cn_smoothed));
gn_smoothed(cn_smoothed <= c0) = (cn_smoothed(cn_smoothed <= c0) / c0) .^ (rho - 1);
yn_smoothed = gn_smoothed .* x;

figure('Name', 'Smoothed Output Signal vs Smoothed Gain Signal (3.10)');
subplot(1, 2, 1);
plot(n, yn_smoothed, 'LineWidth', 1.5);
title('Smoothed Output Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([-5 5]);

```



```

grid on;
subplot(1, 2, 2);
plot(n, gn_smoothed, 'LineWidth', 1.5);
title('Smoothed Gain Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([-2 2]);
grid on;

```

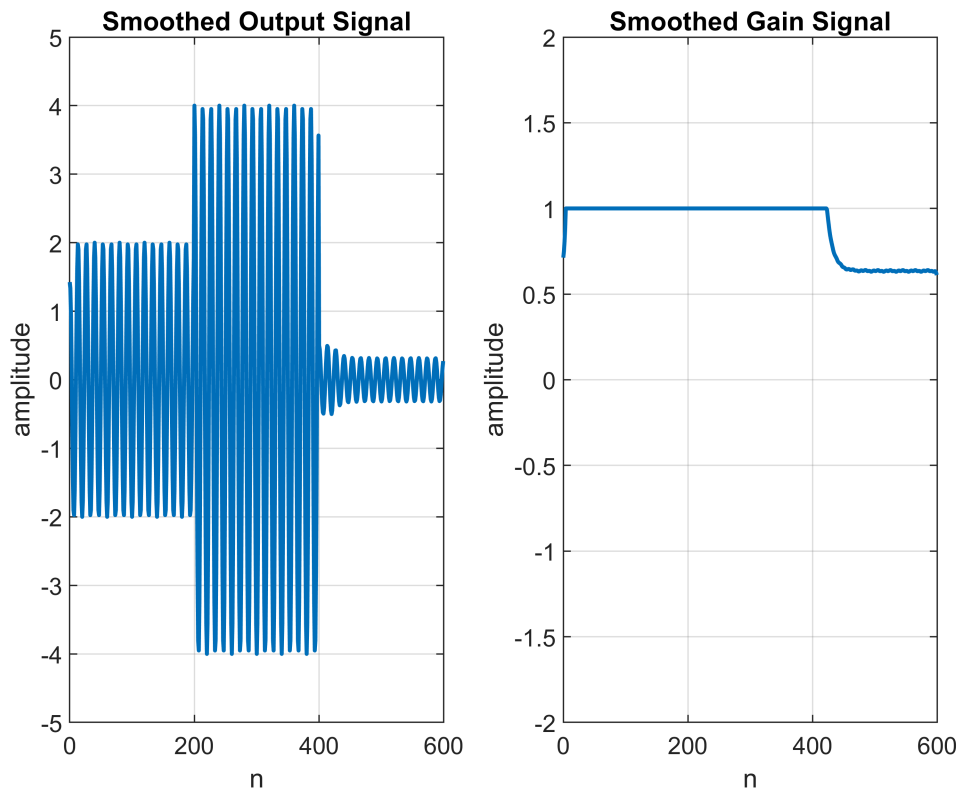


Fig 3.11

```

lambda = 0.1;
c0 = 0.5;
rho = 10;
b = 1 - lambda;
a = [1, -lambda];
cn = filter(b, a, abs(x));

L = 7;
cn_smoothed = movmean(cn, L);
gn_smoothed = ones(1, length(cn_smoothed));
gn_smoothed(cn_smoothed <= c0) = (cn_smoothed(cn_smoothed <= c0) / c0) .^ (rho - 1);
yn_smoothed = gn_smoothed .* x;

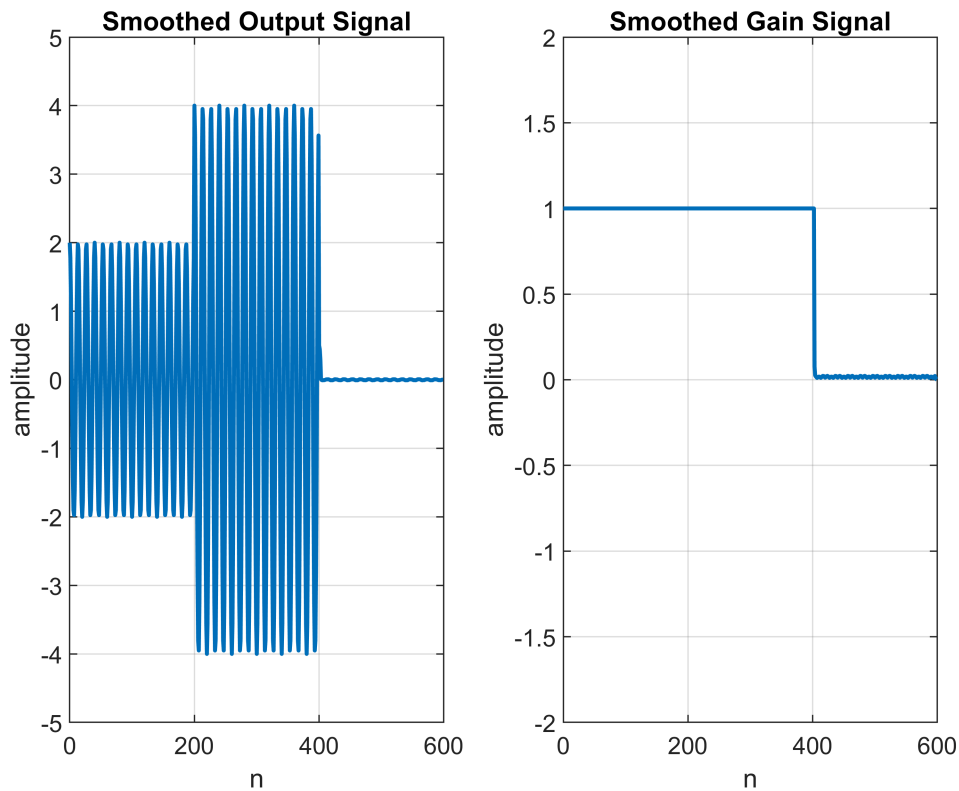
figure('Name', 'Smoothed Output Signal vs Smoothed Gain Signal (3.10)');
subplot(1, 2, 1);
plot(n, yn_smoothed, 'LineWidth', 1.5);

```

```

title('Smoothed Output Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([-5 5]);
grid on;
subplot(1, 2, 2);
plot(n, gn_smoothed, 'LineWidth', 1.5);
title('Smoothed Gain Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([-2 2]);
grid on;

```



Homework3

Here we want to replot figures 3-6, 3-7 with $\rho=0.25$

Control Signal

```

lambda = 0.9;
c0 = 0.5;
rho = 0.25;
b = 1 - lambda;
a = [1, -lambda];
cn = filter(b, a, abs(x));

```

Gain Signal

```
gn = ones(1, length(cn));  
gn(cn >= c0) = (cn(cn >= c0) / c0) .^ (rho - 1);  
yn = gn .* x;
```

Plot Signals

Fig 3.6

```
figure("Name", 'Input Signal vs Compressed Signal (3.6)');  
subplot(1, 2, 1);  
plot(n, x, 'LineWidth', 1.5);  
title('Input Signal');  
xlabel('n');  
ylabel('amplitude');  
xlim([0 600]);  
ylim([-5 5]);  
grid on;  
subplot(1, 2, 2);  
plot(n, yn, 'LineWidth', 1.5);  
title('Compressed Signal');  
xlabel('n');  
ylabel('amplitude');  
xlim([0 600]);  
ylim([-5 5]);  
grid on;
```

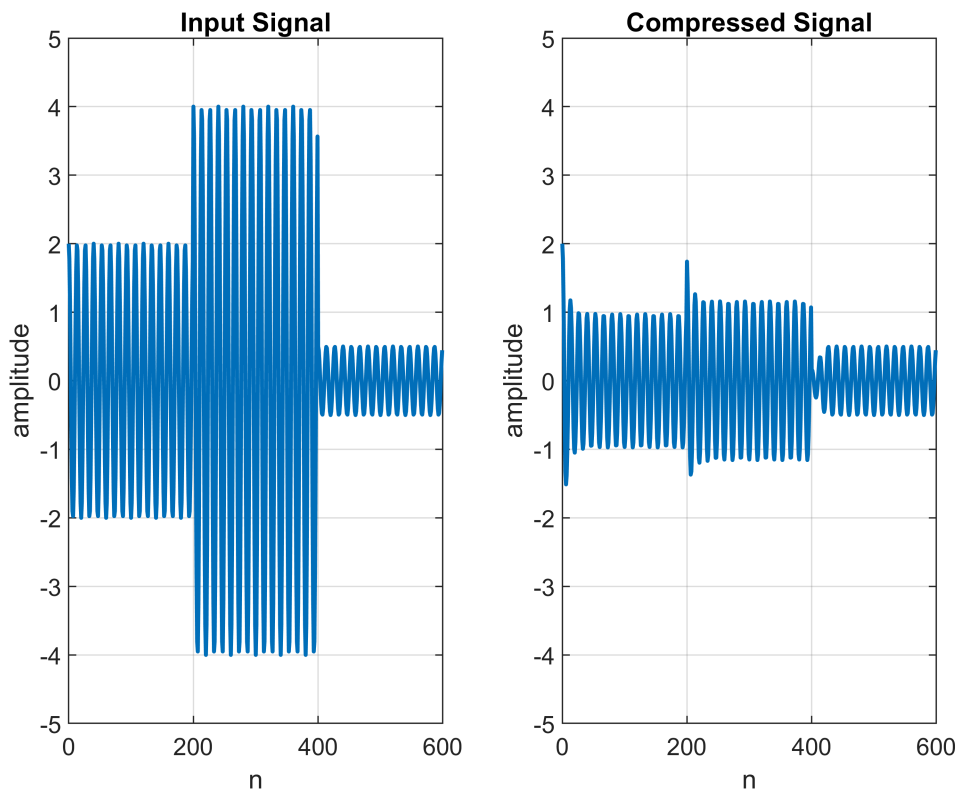
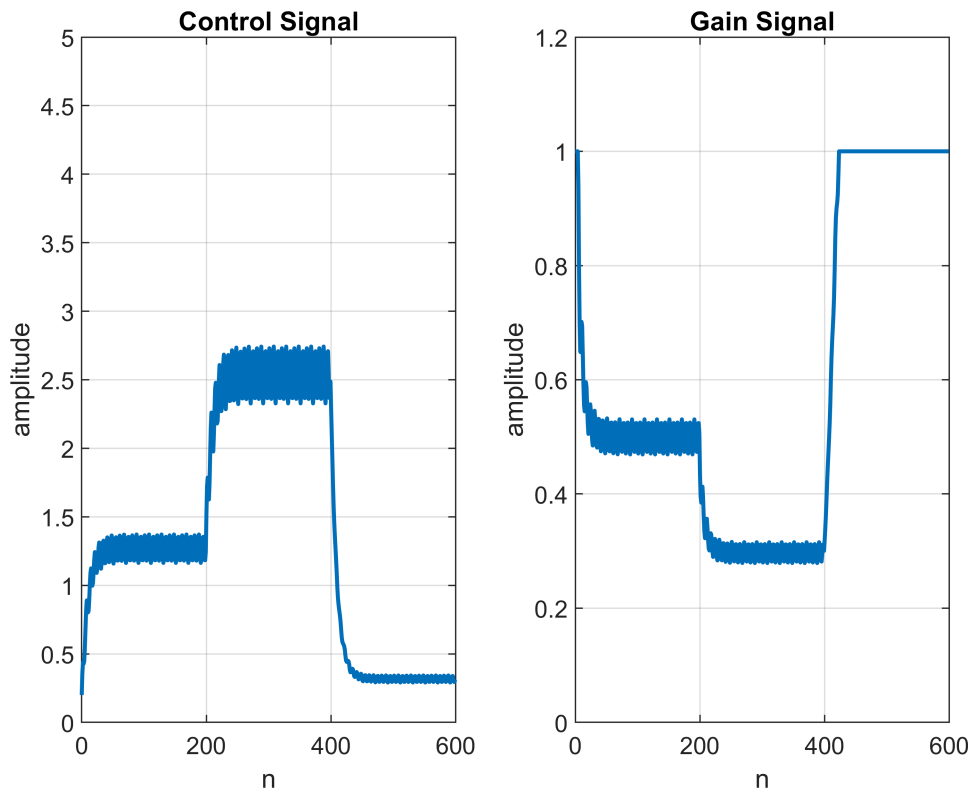


Fig 3.7

```
figure('Name', 'Control Signal vs Gain Signal (3.7)');
subplot(1, 2, 1);
plot(n, cn, 'LineWidth', 1.5);
title('Control Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([0 5]);
grid on;
subplot(1, 2, 2);
plot(n, gn, 'LineWidth', 1.5);
title('Gain Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([0 1.2]);
grid on;
```



Homework4

Here we want to replot figures3-6, 3-7 with declared variables below

Control Signal

```
lambda = 0.9;
```

```

c0 = 1.3;
rho = 0.5;
b = 1 - lambda;
a = [1, -lambda];
cn = filter(b, a, abs(x));

```

Gain Signal

```

gn = ones(1, length(cn));
gn(cn >= c0) = (cn(cn >= c0) / c0) .^ (rho - 1);
yn = gn .* x;

```

Plot Signals

Fig 3.6

```

figure("Name", 'Input Signal vs Compressed Signal (3.6)');
subplot(1, 2, 1);
plot(n, x, 'LineWidth', 1.5);
title('Input Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([-5 5]);
grid on;
subplot(1, 2, 2);
plot(n, yn, 'LineWidth', 1.5);
title('Compressed Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([-5 5]);
grid on;

```

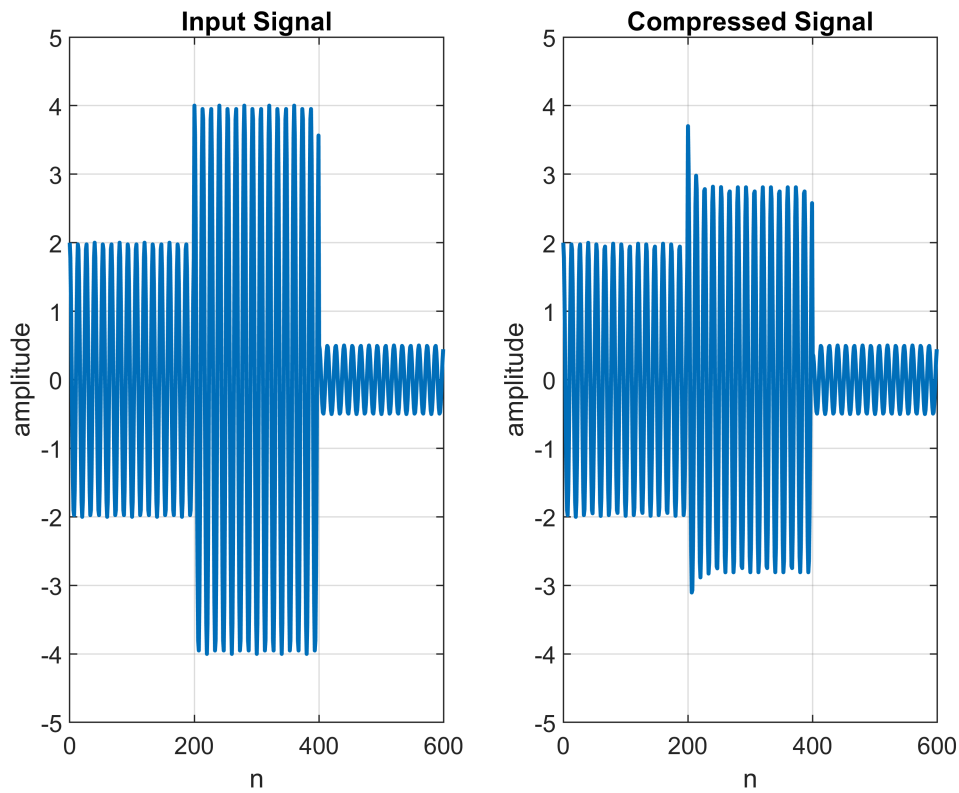


Fig 3.7

```
figure('Name', 'Contol Signal vs Gain Signal (3.7)');
subplot(1, 2, 1);
plot(n, cn, 'LineWidth', 1.5);
title('Control Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([0 5]);
grid on;
subplot(1, 2, 2);
plot(n, gn, 'LineWidth', 1.5);
title('Gain Signal');
xlabel('n');
ylabel('amplitude');
xlim([0 600]);
ylim([0 1.2]);
grid on;
```

