Lab Work Code

```
vel_1 = out.velocity;
plot(vel_1);
filewrite(vel_1.data,"slmcnm_part1");
plot(fileread("filtered_data"))
%%
simin = out.velocity;
%%
output_data = out.simin_out;
plot(output_data)
title("Filtered")
filewrite(output_data.data,'filtered_data')
y_values = output_data.data;
t_values = out.tout;
gain = round(mean(     y_values( round(0.2*length(y_values))  :end)   ))
position = 8;
tau = (-1*t_values(position)) / log(  (gain- y_values(position))/gain       )
filewrite([gain tau],'foaprox');
%%
t_approx = linspace(0,10,10001);
y_approx = gain - gain*exp(t_approx/(-1*tau));
plot(t_approx,y_approx)
title('aprox')
filewrite(y_approx,'bnamcnm_part2_aprox')
%%
sim_output = out.vel_sim;
plot(vel_1);
hold on;
plot(t_approx,y_approx)
title("on top");
legend('1','2')
filewrite(out.y.data,'ki=20kp')
%%
simdata = fileread("tuned_datas1")
tsimdata = linspace(0,10,length(simdata))
plot(tsimdata,simdata,"LineWidth",1.5)
hold on
plot(out.velocity)
%%
filewrite(out.velocity.data,"part4")
%%
function filewrite(x,name)
    filename = append(name,'.txt');
    % open your file for writing
    file1 = fopen(filename,'wt');
    % write the matrix
    fprintf(file1,'%f\n',x);
    % close the file
    fclose(file1);
end
```

Plotting Code

```
part1 = fileread("slmcnm_part1");
fineplot(linspace(0,10,length(part1)),part1,'Raw Data','t','y(t)',[-1,10],
[-10,180],'off',[400 400])

part2_1 = fileread("filtered_data");
fineplot(linspace(0,10,length(part2_1)),part2_1,'Filtered Data','t','y(t)',
[-1,10],[-10,180],'off',[400 400])

%gain and tau of first order
disp(fileread("foaprox"))

part2_2 = fileread("bnamcnm_part2_aprox");
fineplot(linspace(0,10,length(part2_2)),part2_2,'Approximated Data','t','y(t)',
[-1,10],[-10,180],'off',[400 400])

hold off
plot(linspace(0,10,length(part1)),part1,"LineWidth",1.5)
hold on
plot(linspace(0,10,length(part2_1)),part2_1,"LineWidth",1.5)
fineplot(linspace(0,10,length(part2_2)),part2_2,'Approximated Data','t','y(t)',
[-1,10],[-10,180],'off',[400 400])
hold off
legend({'Raw Data','Filtered Data','Approximation'},'Position',[0.6 0.3 0.1 0.1])

part3_1 = fileread("first_PI");
fineplot(linspace(0,10,length(part3_1)),part3_1,'Untuned PI
Controller','t','y(t)',[-1,10],[-10,140],'off',[400 400])
grid on

part3_2 = fileread("tuned_datası")
fineplot(linspace(0,10,length(part3_2)),part3_2,'Tuned PI Controller','t','y(t)',
[-1,10],[-10,140],'off',[400 400])
grid on

subplot(2,2,[1,3])
t = linspace(0,10,length(part3_2));
fineplot(t(1:round(length(t)*0.06)),part3_2(1:round(length(t)*0.06)),'Rise Time
and Rising Curve','t','y(t)',[-0.05,0.6],[-10,140],'off',[400 400])
grid on
subplot(2,2,2)
fineplot(t(1:round(length(t)*0.06)),part3_2(1:round(length(t)*0.06)),'Rising
Corner and Overshoot','t','y(t)',[-0.05,0.6],[119,121],'off',[400 400])
grid on
subplot(2,2,4)
fineplot(t(1:round(length(t)*0.9)),part3_2(1:round(length(t)*0.9)),'Steady State
Error (Zoomed)','t','y(t)',[-1,9],[119.99,120.01],'off',[400 400])
grid on

clf;
part3_3 = fileread("ki=20kp");
```

```
fineplot(linspace(0,10,length(part3_3)),part3_3,'K_i = 20K_p PI
Controller','t','y(t)',[-1,10],[-10,160],'off',[400 400])

part3_4 = fileread("kp=10ki_datası");
fineplot(linspace(0,10,length(part3_4)),part3_4,'K_p = 10K_i PI
Controller','t','y(t)',[-1,10],[-10,160],'off',[400 400])
grid on

part4 = fileread("part4")
plot(linspace(0,10,length(part4)),part4)
grid on
hold on
fineplot(linspace(0,10,length(part3_2)),part3_2,'Tuned PI Controller
Overlaid','t','y(t)',[-1,10],[-10,140],'off',[400 400])
legend({'Raw Data of PI Controller','Simulation of PI Controller'},'Position',
[0.6 0.3 0.1 0.1])

part4_2 = fileread("filtered_PI");
plot(linspace(0,10,length(part4)),part4)
hold on
plot(linspace(0,10,length(part4_2)),part4_2)
fineplot(linspace(0,10,length(part3_2)),part3_2,'Filtered Tuned and Simulated PI
Controller Overlaid','t','y(t)',[-1,10],[-10,140],'off',[400 400])
legend({'Raw Data of PI Controller','Filtered Data of PI Controller','Simulation
of PI Controller'},'Position',[0.6 0.3 0.1 0.1])

subplot(2,2,[1,3])
t4_2 = linspace(0,10,length(part4_2));
fineplot(t4_2(1:round(length(t4_2)*0.06)),part4_2(1:round(length(t4_2)*0.06)),'Ri
se Time and Rising Curve','t','y(t)',[-0.05,0.6],[-10,140],'off',[400 400])
grid on
subplot(2,2,2)
fineplot(t4_2(1:round(length(t4_2)*0.06)),part4_2(1:round(length(t4_2)*0.06)),'Ri
sing Corner and Overshoot','t','y(t)',[-0.05,0.6],[117,123],'off',[400 400])
grid on
subplot(2,2,4)
fineplot(t4_2(1:round(length(t4_2)*0.9)),part4_2(1:round(length(t4_2)*0.9)),'Stea
dy State Error (Zoomed)','t','y(t)',[-1,9],[117,123],'off',[400 400])
grid on

function xread = fileread(name)
    filename = append(name,'.txt');
    % open your file for reading
    file1 = fopen(filename,'r');
    % write the matrix
    xread = fscanf(file1,'%f\n');
    % close the file
    fclose(file1);
end
```